PREFACE

For the past decades development policy has sought to eliminate poverty at its roots in rural areas, creating a livelihood attractive enough to keep the youth in place and control migration. The dynamics of real life economics, however, were only gradually affected by these efforts. Young people go for jobs – jobs are where the money is – and capital continues concentrating in cities, thus turning them into the driving forces of national economies. In addition, ecological, climatical and political crisis create new waves of migration to the cities. In 2025 the world's urban population is expected to reach 5.5 billion, 80% of which will live in urban centres of developing countries. Many of those who migrate to cities, however, fail to obtain the desired occupation, being forced to organize their survival at subsistence levels in slums, mushrooming at the outskirts. An increasing proportion of the target group for poverty alleviation in developing countries is now found in urban centers.

Many find employment in commercial urban agriculture in open spaces or improve the quality of their families daily diet by a range of urban agriculture activities like e.g. homegarden production or lifestock keeping. Some even, once established in the city, obtain access to the neccessary resources and selfemploy in urban agriculture.

Developing cities that suffered from recent economic crisis, have seen a sudden upsurge of urban agriculture activities and reoriented their initially discriminating or prohibitive policy in favour of urban agriculture to sustain a better livelihood for the mostly affected population groups, thus accepting its function as a risk-reducing strategy in time of crisis.

While the western world has already gone through the hot phase of urbanization, with enough time to structurally adjust and build smaller and medium sized centers, many developing countries shortcut this period facing accelerated urbanization at rates that absorb rural population into megacities much faster than organized growth and infrastructural development can cope with. Rural-urban linkage is greatly affected by the lack of balance in this trend, which presents a challenge to sustainable urban and peri-urban development, with a perspective to adapt and integrate concepts of rural development like food security, income generation and sustainability.

Developed countries dispose of the entire infrastructure to import whatever they need within a few hours time in cool chains, airplanes, trains and trucks. Due to poor transport infrastructure and related high cost many fast-growing cities in developing countries lack the necessary hinterland to satisfy their demand for basic but highly perishable agricultural products like vegetables, milk or meat. The relative proximity to the consumer gives intensive production in and near the city along the major transport veins a comparative advantage over up-country production, thus favouring market-oriented commercial urban and peri-urban agriculture.

The consumption of enormous quantities of organic materials, like i.e. food, brought into cities results in a correspondingly high production of organic waste, which accounts for 2/3 of the total urban waste. Recycling of urban organic waste in urban and peri-urban agricultural activities closes these nutrient cycles, reduces the cost of waste disposal and serves as an environment-friendly solution to some of the negative ecological impact of cities. At the same time urban agriculture can serve as a tool to maintain green open spaces in urban areas.

The positions of policy makers regarding urban agriculture range from strong support by official policy (e.g. some socialist countries like China, Cuba, etc.) to ignorance of its importance for the informal sector or discrimination reducing it to an illegal activity.

The dispute over urban agriculture as a valid concept for sustainable urban development has recently gained momentum and draws the attention of a growing number of municipalities, bi- and multilateral organizations, NGO's and universities to the subject.

This reader is a joint effort of 6 development organizations (bi-lateral, multi-lateral and NGO) to broaden the resource base for this discussion. It emerged from case studies and thematic articles funded by **BMZ** through **GTZ**, coordinated and edited by ETC, and the results of an international workshop in Havana, Cuba (October 10–15, 1999) organized by **DSE**, **CTA**, **Sida** and **ACPA**, with technical support of **ETC** and **WHH**.

Its two major parts: the thematic articles that highlight specific aspects of urban agriculture and the case studies from selected cities in Asia, Africa, Latin America and Europe, pursue a systems-oriented approach to understand urban agriculture under different political, economic, demographic and ecological conditions.

The individual chapters have usually been written by teams of authors. In particular the case studies were either entirely by, or with the participation of local authors to ensure the intimate knowledge of the given situation. The Reader allows for reading the chapters in order of particular personal interest. The sequence of the thematic articles however, intends to gradually build up knowledge of and understanding for the function and role of urban agriculture as an integral component of sustainable urban and peri-urban development.

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URBAN AGRICULTURE: DEFINITION, PRESENCE, POTENTIALS AND RISKS

Luc J.A. Mougeot

1. Introduction

Ever since the first French geographical accounts of (intra- and peri-) urban agriculture (UA) were published on Central Africa in the 1960s, scattered and isolated UA surveys by individual social scientists (e.g. Egziabher et al. 1994) have gradually been giving way to institutional projects led by multidisciplinary teams. As a result, more and better information is now available on a larger number of regions, countries and cities around the world. Over the same period, public initiatives pioneered by few local and national governments have been followed by more widespread awareness on the part of local authorities, in their regional and global fora, for the growth and potential of agriculture in and around cities. More urban governments are now seeking to exchange policy and technical experiences to better deal with a spreading phenomenon in their own city.

Initial pilot projects by a handful of donors (Mougeot 1999a) have paved the way to greater collaboration and co-ordination among international support and executing institutions, for information, assistance, training and policy in UA (IDRC/TUAN 1996, SINA 1998).

We must work harder to bring Urban Agriculture (UA) to its conceptual maturity; only with greater internal coherence and external functionality will it turn into a distinctive and useful tool for us to understand and intervene. Key features of current definitions of UA generally have downplayed a critical trait that makes UA to be urban. UA is different from, and complementary to, rural agriculture in local food systems: urban agriculture is integrated into the local urban economic and ecological system. Unless this dimension is enhanced and made operational, the concept will remain little useful on the scientific, technology and policy fronts.

On the ground, UA is growing out of its ability to assist with, resolving or coping with diverse development challenges. It is spurred by a complex web of factors still little understood, not the least of which are urban poverty and food insecurity. Little attention in particular has been paid to the women who tend to predominate in UA, an activity which connects well not only with their care-taking and house-holding roles, but also increasingly with their need for income. UA practitioners can be categorized variously, based on a combination of tenure modality, time allocation and product destination. Differences are further observed across regions of the world, in terms of prevailing urban agriculture production systems and associated problems.

Official support to UA is age-old, has been diverse and can be organised into several types of interventions, often combined in a single city. Access to resources, land in particular, is central; access is more often an issue than availability per se. But UA production systems have diversified and producers have adapted to cope with these and other urban constraints and opportunities.

We must better understand how urban food systems work if we want to comprehensively assess and promote UA's role and impact on the welfare of particular rural and urban communities. UA tends to complement rural and foreign sources of food supply to cities. It has been promoted to effectively do so and is important to strengthening poor urban households' food security in particular.

Despite limited support and heavy losses, UA is generating products valued in the tens of millions of USD, year in and year out, in major LDC urban centers. UA is comparatively affordable, a noteworthy source of income and savings and is more profitable than rural-based production. The up and downstream effects of UA in the local economy are largely unknown and could be considerable. Low-income UA effectively contributes in several ways to reduce food insecurity by improving food intake of households and by raising children's nutritional status; this relationship could be gender-mediated.

There is little literature overtly condemning UA under any form; opposition has tended to come more from urban planning, public health and environmental circles than from agencies covering employment, community services and agriculture. Governmental checks and balances exist and have been applied to a limited extent. Regulations have remained largely ineffective and must be revised, priorised and implemented in an appropriate and participatory way; they need to be enabling. Concern over agrochemical use in UA tends to be exaggerated; actual use and related problems are limited by various factors, particularly in the case of intra-urban, home-based, women-practiced, food self-provisioning. More information seems to exist on evidence and on measures to curb public health risks posed to

UA by ambient factors, as opposed to risks introduced by UA into the urban environment. Still, the latter is a source of rising governmental concern. In both cases problems are technically manageable; however, this depends on cities making better use of prevention and mitigating measures, including trans-sectoral coordination (waste management) and the use of UA to enhance environmental quality.

Several trends underway will buttress the growth of UA worldwide and in LDCs in particular. Risks and benefits must be addressed through active policy-making and doing. So far, UA development has been assisted largely by actors in urban politics and agricultural policy circles, for poverty alleviation and food security. This measure of support now is insufficient to deal with the growing risks and benefits posed by the expansion of UA in LDCs. A fuller integration of UA into the urban eco-system requires that urban planners, public health and environmental management actors join in with others committed so far. Areas of intervention at the community, city, national and international levels are identified, where more efforts should concentrate relative to recent progress. More needs to be done by actors on the national and internal planes that will help communities and cities to capitalize on their collective experience and to integrate UA into the city organism in a fairer, more viable and sustainable way.

2. Definitions: what is intra- and periurban agriculture?

2.1 Concept development

Whether we agree or not with the phenomenon, the expression “urban agriculture” (UA), or “intra- and peri-UA”, originally used only by scholars and the media, has now been adopted by UN agencies such as the UNDP (Smit et al. 1996b) and FAO (FAO 1996; COAG/FAO 1999). This makes our need to define it self-evident, at least for our short- and mid-term governance.

Our effort to define UA should bear purpose. The concept of UA should possess a distinctive architecture of its own, both on content and form, and evolve through its interaction with the development of related concepts. Concepts are mental tools that we forge – and eventually rework – to better understand, interact with and modify our real-world experience. They are historically and culturally bound, relevant in some places and less so in others, fitting today but perhaps less so tomorrow. The UA concept needs to evolve out of our need to codify and refine our perceptual experience with a rather new world phenomenon, so as to ensure that it remains or becomes more useful to us where we will need it. Its identity depends on this external functionality as much as on its internal coherence.

Internal coherence: Is UA really what we call, or want to call, what we perceive to be out there? Stevenson et al. (1996) rightly insist on our need to distinguish, for instance, between agriculture "in the periurban zone" and "periurban" agriculture. The overarching definition should lead us into a full conceptual system or edifice, a structure of interconnecting compartments anchored into real-world experience. Another way of looking at this system is to see a pyramid, with lower levels containing larger numbers of more operational and interdependent terms. Within and subordinated to the overarching concept, situational variations should be allowed for the sake of local and regional relevance. To build a useful and viable UA edifice requires probably more materials and engineering than assembled so far.

External functionality: How does UA position itself relative to other "kids on the block" (e.g. rural agriculture, sustainable urban development, urban food supply systems, etc.)? The overarching concept should be clear enough so that users can easily perceive its potential for complementarity and synergy with related concepts. How distinctive and value-adding is this edifice in the neighbourhood where it is being built?

We should expect interaction between the UA concept's internal and external planes to drive its evolution and renew its usefulness. Only then can the UA concept provide a yardstick against which to identify empirical manifestations and gauge how these may reflect the concept, at any given time or location (e.g. the operational translation of the UA concept should enable us to grade specific agricultural activities observed in particular urban areas). A conceptual yardstick is fundamental, as policy and technology interventions need first and foremost to identify meaningful differences and gradations, if they are to better assess and intervene with appropriate means for promotion and/or management of UA.

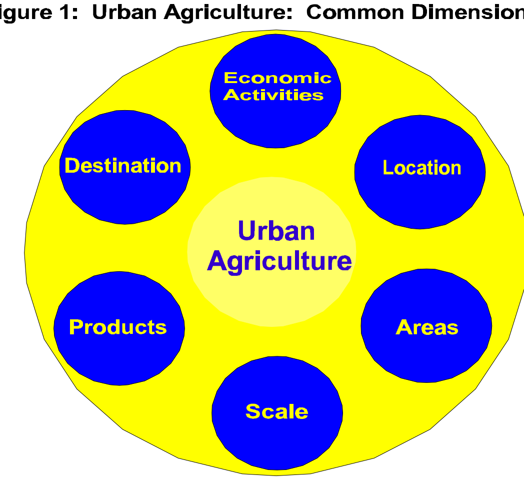
2.2 Building blocks of current definitions

Recent reviews have collated definitions of UA (Quon 1999) and identified shifting emphases in definitions throughout the history of research on UA (Mougeot 1996). This section instead highlights common building blocks of the concept, reviews them and submits a critical direction for enhancing its conceptual distinctiveness.

The more common conceptual building blocks of UA identified are: types of economic activities, food/non-food categories of products and subcategories, intraurban and periurban character of location, types of areas where it is practised, types of production systems, product destination and production scale (see Figure 1).

Types of economic activities: Most definitions refer to the production phase of agriculture; recent definitions add processing and trade to production and stress interactions between these. Besides being sound, commodity analysis affords an integrated approach which is particularly relevant to UA where, differently from most rural agriculture, production and marketing (and also processing) tend to be more interrelated in time and space, thanks to greater geographic proximity and quicker resource flow. This is achieved by small and dispersed units, which make up an extensive and decentralised supply system within immediate reach of a massive consumption market. Economies of agglomeration seem to prevail over those of scale, the latter being more important in rural agricultural production. In UA, economies of scale through co-operative efforts may further enhance the benefits of unit-based vertical integration.

Figure 1: Urban Agriculture: Common Dimensions



Food/non-food categories and sub-categories: The definitions embrace very diverse agricultural productions, though more highlight food productions fit for consumption by either people or livestock; then, mostly cultivated or raised food products (grain, root, vegetable, aromatic and medicinal herbs and fruit crops, and livestock of all shapes and sizes). A smaller number deal with other plants, such as ornamental and agroindustrial (e.g. silk worms, tobacco). Within food crops, definitions clearly stress the more perishable and relatively high-valued vegetable and animal products and by-products. Several studies consider food production exclusively, while others encompass both food and non-food production. As such systems are often mutually complementary, often gendered, they reinforce not only food security but also economic and environmental benefits at various levels (from individual to city). To exclude the non-food category from the general UA concept would truncate our understanding of the UA system at large. Exchanges are taking place across production systems and within particular production units. Many ways exist in which UA interacts with other urban functions to use and provide resources, outputs and services to the city.

Intraurban/periurban character of location: By far the element most common to reviewed definitions is location “in (within) and around” cities or urban areas (e.g. Ganapathi 1983, Sawio 1993, Smit et al. 1996b, COAG/FAO 1999). This element is probably the biggest source of contention, which is why it will be discussed more at length than other elements. Most UA field studies have been carried out in large urban centres, national capitals or secondary cities; thus, few can be assumed to have largely dealt with agriculture located in rural areas “typical” of the respective countries. However, few actually differentiate between intra- and periurban locations. Those which do so have used as criteria, for intraurban agriculture, population sizes, density thresholds, official city limits (Gumbo & Ndiripo 1996, Murray 1997), municipal boundaries of the city (Maxwell & Armar-Klemesu 1998), agricultural use of land zoned for other use (Mbiba 1994), agriculture within the legal and regulatory purview of urban authorities (Aldington 1997). In a rare comparison between rural and urban agriculture, Moustier (1998) defines UA as that carried out within or on the outskirts of a city where a non-agricultural use of local resources is a real option; rural agriculture is found in areas where this option is not an issue. In the CIRAD-Agricongo study of (open-space) market vegetable farming in Brazzaville, for instance, gardens within the city limit are labelled “intraurban” whereas those off-limit (though within a certain travel-time band – see below) are called “periurban” (Moustier 1999).

For **periurban agriculture**, the locational definition is more problematic. In contrast to intraurban locations well within the older and more settled urban fabric, periurban locations are in closer contact with rural areas and tend to undergo, over a given period of time, more dramatic agricultural changes than do locations in more central and built-up parts of the city. Many authors recognise the need to differentiate peri-UA from intra-UA, but criteria used vary widely. For instance, the periurban area is one where “the advantages of combining farm and non-farm work can be maximised” (Swindell, quoted by Binns & Lynch 1998). Sumberg

(1997) applied the OCDE definition to a study of the urban milk system in Dar es Salaam; the Natural Resource Institute supplemented this definition, stressing land shortage and pollution pressures from urban expansion (NRI 1995). In the Greater Accra study, Maxwell et al. (1998) emphasised land-market pressures and changes in agricultural production. In South Africa, a sequence of production systems has been proposed which straddle an urban-rural range of population density thresholds.

Authors have been trying to delineate the outer boundary of the periurban area. Stevenson et al. (1996) say that this outer boundary varies, depending on the reach of those urban influences with the greatest impact on the production system considered. Murray (1997) and Losada et al. (1998) have identified urban and periurban zones within metropolitan boundaries of Quito and Mexico City, for urban forestry and animal husbandry studies. The latter further identified a suburban zone, and characterised all three (urban, suburban and periurban) based on varying ratios of buildings and roads and increasing ratios of open space per km^2 (Losada et al. 1998). Others understand the outer boundary of the periurban zone as some isochrone. This travel-time band is more star-shaped than circular in most cases, stretching out along main road corridors and on flat land, while contracting in wedges and rugged sectors; it can be defined by the travel time of non-resident farmers to their farm or the travel time of specific products to reach the urban market. Lourenço-Lindell (1995) used the area within which people living within the city's administrative boundaries can travel to engage in agricultural activities. Moustier (1998) used the maximum distance away from city centre within which farms can supply perishables to the city on a daily basis; Mwamfupe (1994) used the maximum distance which urban residents could travel to their farms in the periurban area on a daily basis (quoted by Stevenson et al. 1996). Stevenson et al. (1996) themselves proposed the maximum distance within which a given percentage of producers can sell their crop at farm-gate. How far from the city this outer limit will be drawn will depend on the level of development of the local road infrastructure and transportation costs: 10 km wide in Bissau, Guinea-Bissau, but 20 km in Brazzaville, Dar es Salaam or Kumasi (NRI 1995). According to these criteria strictly, this limit falls at least 90 km away from Metro Manila (Ali & Porciuncula 1999).

Types of areas where UA is practised: Criteria according to which such areas are typified vary from author to author: location respective to residence (on-plot or off-plot), development status of site (built-up vs open-space), modality of tenure/usufruct of site (cession, lease, sharing, authorised or unauthorised - through personal agreement, customary law or commercial transaction); the official land-use category of the sector where UA is practised (residential, industrial, institutional, etc.). While some authors have focused on home-plot areas (Lee-Smith et al. 1987, Régis 1999), others have aimed their study at off-plot and open-space locations (Freeman 1991, Mbiba 1994, Kiango & Likoko 1996, Dennery 1996, del Rosario 1999). Misleading comparisons are often drawn across separate studies without due regard to the locational focus of original surveys. Some surveys have encompassed both on- and off-plot locations, under different tenure/usufruct modalities, revealing creative interactions between such locational categories (Maxwell 1995, Sawio 1993, Drescher 1996).

Product destinations: Most definitions embrace agricultural production for both self-consumption and some trade (sale, barter, gifts, etc.). Both destinations are usually found to be targeted to varying degrees by the producers or households studied. Economic research recently has been aimed at specific (export) market-oriented production and has helped us to better understand the economic performance of UA and its comparative advantages over other supply sources, both at the producer and consumer level. On the self-consumption plane, relatively more attention must be given to the economics of animal assets and the fungibility of supplemental food self-consumption afforded by UA to households. Whereas in Accra, little attention was paid to the asset value of small livestock, a study in Cairo, a city thrice as densely peopled as Accra and with only 3% of its precipitation, revealed that nearly 30% of low-income households in informal housing had livestock worth on average nearly a full month of income (GTZ 1999).

Production systems (scale of): Few definitions clearly include or exclude specific types of production systems *a priori*. Surveys collect data on the different types of systems found in the area under study (see other section for details). Generally, the research effort has focused on individual/family micro, small and medium enterprises, as opposed to large, national or transnational undertakings. However, recent studies show that the bigger interact in more than one way with smaller market-oriented units, often even to the expense of units primarily geared to self-consumption (periurban areas). Corporate outsourcing has been practised for some time in UA, particularly in Asian cities, but trade liberalisation is also making it attractive in a growing number of types of production and cities in Africa and Latin America.

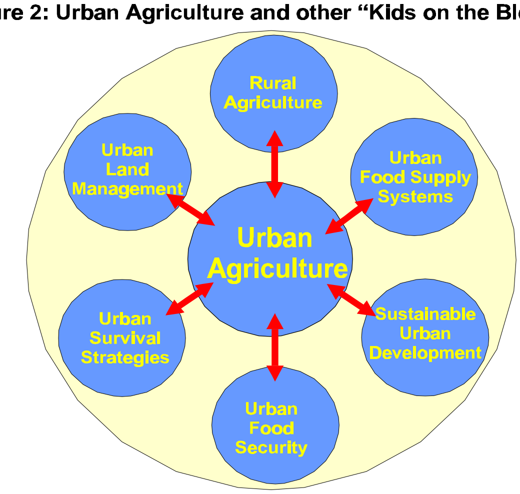
2.3 The urban ecosystem connection: a neglected trait of the concept

Most authors define UA only in general terms; this is then often developed into some typologies to organise data analysis on the afore-reviewed dimensions of the concept. Studies rarely use their findings to refine the UA concept of the day (Mbiba 1998) and to clarify UA's distinctiveness, or how UA relates to the body of related development concepts (see Figure 2). Smit et al. (1996b) briefly discuss the connection of UA with the urban nutrient cycle and with the urban food system. Several authors have further incorporated UA in their analysis of related concepts, e.g. on rural agriculture (Moustier 1998); on food entitlements (Lourenço-Lindell 1995); on food security (Koc et al. 1999); on urban households' survival strategies (Rakodi 1995); on urban food supply systems (Smith 1998); on urban land management (Lee-Smith 1998, Girardet 1992) and on sustainable urban development (Mitlin & Satterthwaite 1996). This has generally been done more on a theoretical plan than in operational terms, because of the UA concept's lack of clarity (Lee-Smith 1998, Binns & Lynch 1998, Sumberg 1999).

One striking feature of definitions so far is that few contrast urban and rural agriculture, even less so the implications of one for the other (Binns & Lynch 1998). Indeed, all building blocks reviewed earlier, excepted location, can apply to rural agriculture as well; they do not suffice to trademark UA and justify the need for UA-specific knowledge, know-how and policy. The following paragraphs identify some aspects on which efforts should concentrate and provide some evidence to clarify UA's distinctiveness.

The lead feature of UA which distinguishes it from rural agriculture is its integration into the urban economic and ecological system (hereon referred to as "ecosystem"). It is not its urban location which distinguishes UA from rural agriculture, but the fact that it is embedded in and interacting with the urban ecosystem (Richter et al. 1995). Integration into the urban system has been crucial to the persistence of UA,

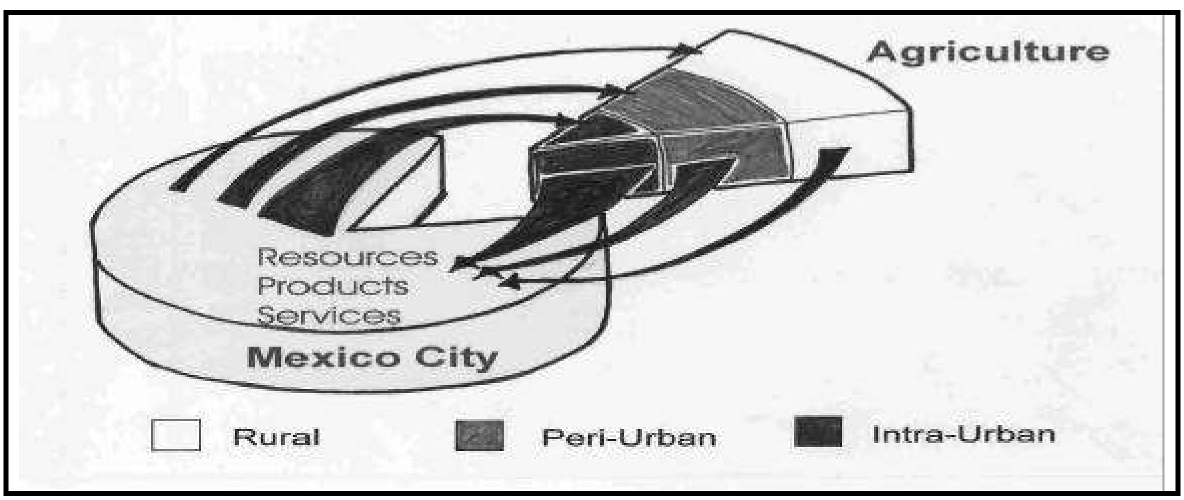
Figure 2: Urban Agriculture and other "Kids on the Block"



more so to its technological and economic influence over rural agriculture throughout history. Probably as old as our cities (Jacobs 1969), UA has not been an exceptional nor a temporary pursuit. Though the nature of cities and of urban food-supply systems has changed, the need for UA to interact well with the rest of the city, on one hand, and with rural production and imports, on the other, remains as true today as it was thousands of years ago.

This integration with the urban ecosystem is not captured in most definitions of the UA concept, and less so developed in operational terms. This is an area in need of much greater attention beyond initial steps taken by a few. For instance, the definition by Smit et al. (1996b) of UA stresses the recycling of urban waste and the catering to the daily urban demand; this adds to the locational feature of earlier definitions an urban input-urban output loop. A revised definition is submitted as follows: **UA is an industry located within (intraurban) or on the fringe (periurban) of a town, a city or a metropolis, which grows or raises, processes and distributes a diversity of food and non-food products, (re-)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area** (see Figure 3).

Figure 3: "Urbanising" agriculture in (Mexico) city using more from, and supplying more to, (Mexico) city



The principle of agriculture's integration into the urban ecosystem enables us to recognise three types of situations with regard to the degree to which agriculture found in the city is actually integrated into the city organism (Figure 4):

(A) In any given city at any given time, agriculture will be found that is rural, periurban and intraurban in nature, the three interacting and complementing each other to varying extents, with the latter being more integrated into the urban ecosystem.

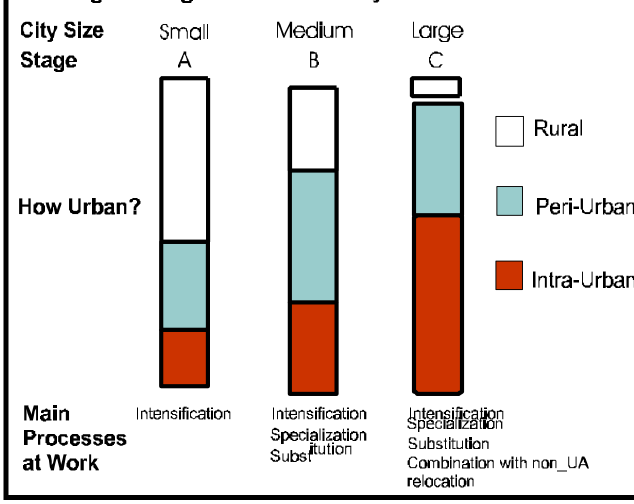


Figure 4: Agriculture in the City: How Urban Is It?

In order for agriculture found in cities to become more urban in character, this must innovate to cope effectively with city constraints and tap no less effectively on urban assets and flows found and generated by the city. In turn, it benefits this (and others) with its products and services on a daily basis. Agriculture will be more or less urban, according to the extent to which it will use the urban ecosystem and, in turn, be used by this same urban ecosystem.

This concept enables us to assess conditions and policy interventions needed, if any, to move from lesser to greater integration.

Several studies exemplify the principle of integration through comparisons between intraurban, periurban and rural activities. UA is found to complement rural agriculture in terms of self-provisioning, marketing flows and market-supply flows, as shown for instance by CIRAD studies on vegetable and livestock production in West and Central Africa.

Self-provisioning: Specific UA productions are important sources of self-provision for all households, anywhere and anytime. Self-provision from some forms of production affords a measure of self-reliance to urban markets at certain seasons and/or periods of time; self-provision is found to benefit households regardless of their income, but is particularly critical to poor households.

Market supply: Although UA has been growing in absolute terms in most cities surveyed, its contribution to urban food supplies relative to rural agriculture and imports varies, depending on product and season. UA critically flattens price/variety seasonality by lessening dependence on off-season imports, or making up for reduced supplies from rural agriculture during the dry season.

Marketing systems: Fewer levels of trade and a higher percentage of producers are involved in the trade of UA than in rural agriculture or imports. This dispersal of trade corresponds to a dispersal and small scale of UA (demand-supply variability risks, lack of storage and of access to credit by traders). By comparison, the wholesaler-collector function in the marketing system of rural agriculture is much more significant. Volumes traded and transportation costs are larger in rural agriculture, while marginal sale profits and bargaining power of producers against traders are higher in UA (Moustier 1998).

Panigrahi (1995) and Seré & Reinhardt (1995) implicitly use the urban ecosystemic link principle, when identifying distinctive traits of periurban livestock production systems relative to rural counterparts: types of livestock, size and nature of systems are conditioned by urban demand and feed availability; feed resources are generated by urban-based activities (agroindustrial by-products, natural fodder on roadsides and in parks, abundant urban domestic wastes); and form, quality and cost of product constrained by increasingly sophisticated urban consumers. According to the systematic comparisons by Stevenson et al. (1996) of rural, periurban and urban fruit/vegetable production, in Dar es Salaam, the dependence of the production system on urban-origin inputs and on urban-destination outputs clearly increases from the rural (village) to the urban end of the spectrum. At the same time, this growing dependence impresses on production: greater intensification, specialisation, crop value and profit margin.

On the resource level, the urban ecosystemic link of UA has been explored primarily through its reuse of wastes generated by urban agricultural and non-agricultural activities. Growing interest in the link between UA and urban solid and liquid waste treatment and recovery is certainly indicative of the economic attractiveness of the urban ecosystemic dimension of UA.

(B) Across cities of different size or complexity at any given time, more of the agriculture found in the city will be of an urban nature in larger as opposed to smaller centres. Systematic evidence for this relationship remains more limited than for (A). A six-city Kenyan study further shows that intensity and productivity increase with city size; similarly, the use of organic inputs and of networks of exchange or trade increases with city size (Lee-Smith 1998).

(C) In any given city and over a period of time, during urbanisation, agriculture of an urban nature will grow as a percentage of all the agriculture found in that city. In this case, no systematic case study was found on the evolution of UA in a same city over a reasonable period of time.

However, some evidence is available on multiple-year trends for specific systems and areas of Dar es Salaam, Dakar, Hong Kong and Cagayan de Oro, where UA land-based systems have shrunk, intensified or specialised, and have been substituted by more profitable ones, increasingly combined with non-agricultural land uses, when not relocated. Shanghai exemplifies several of these processes at work, with land-extensive systems (vegetables and livestock) moving to the outskirts, while production within city limits is becoming more efficient to deliver higher yields and labour productivity and value-adding (Yi-zzhang 1999).

In all three relationships (A, B and C), agriculture will become more urban, or will integrate itself more into the urban ecosystem, through a series of processes which accumulate over time and are more numerous in the larger urban centres.

In conclusion: the urban ecosystemic link of UA throughout its entire conceptual framework remains to be fully developed. Its conceptualisation currently offers a generic definition and some indications of its distinctive traits. A de-codification of this definition is needed to help us identify its distinctiveness, in both theoretical and operational terms. Efforts in that direction have already begun and are forcing us to distinguish between UA and non-UA in urban areas (the latter will continue to exist with or without a UA concept), between intra-UA and peri-UA, and to examine the place of UA within larger conceptual frameworks. Because UA is claimed or reported to interact with so many facets of urban development, UA also holds the potential to help us diversify and strengthen our urban management strategies. This is not a small opportunity, as city-based electorates struggling for access to food, income and sanitation are increasingly calling the shots in local and national policy arenas.

3. Presence of UA: who is involved and why is it important?

3.1 Who is involved in UA?

The actors involved in UA are many; they are the suppliers of resources, inputs and services and the producers, the transporters and the processors, the retailers and the consumers, the promoters and the managers. These actors pertain to the public and private sectors, the formal and the informal economy. The political relationships which these actors thread among and between themselves as well as with resources are diverse; they can be complementary and synergetic, competitive and antagonistic, collaborative or adversarial, equitable or exploitative. This section focuses on the relationships among producers, between these and retailers, and between these and authorities, particularly with respect to selected issues such as access to land, rural and urban agriculture, and community welfare. These aspects will then be further developed in the thematic articles of this reader.

3.1.i Producers, women producers, classifications

Many stakeholders are involved in UA, but some do it in bigger ways than others. A California-based winemaker imports Chilean grapes from the Santiago region. A Brazilian electricity utility leases out right-of-way parcels to vegetable growers in metro Rio. A Dominican rehabilitation institution in downtown Santo Domingo has inmates grow and sell hydroponic lettuce to nearby supermarkets and ornamentals to high-income neighbours. Zimbabwe’s Harare City Council irrigates cattle pastures with treated municipal wastewater; informal women's co-operatives farm local vacant fields for food and cash. A group of men garden small plots on a church’s unbuilt estate in Tanzania’s capital, Dar es Salaam. Almost everywhere where fresh dairy products are in demand, senior bureaucrats stall-feed dairy cows on their private estates. In Cuba, public-housing residents in Havana and elsewhere grow home vegetables and rainfed root and grain crops in nearby public open spaces; in Peru, women raise guinea pigs at home for sale in Lima and in secondary cities such as Cajamarca.

However, most urban farmers are low-income men and women who grow food largely for self-consumption, on small plots that they do not own, with little if any support or protection. They tend to come from smaller towns; most are not recent arrivals. For instance, a 1994 survey of three different sectors of Nairobi revealed that over 60% of 177 producers had moved to the city before 1985 (Mboganie-Mwangi 1995).

Recent studies indicate that gender ratios vary greatly from city to city, depending on cultural/religious context, the economic conjuncture, the economic activity, the production system, scale and areas involved. In vegetable marketing, men prevail in market gardening in Brazzaville, Lomé, Addis Ababa and Dakar, while men prevail among producers and women in vending in Cagayan de Oro, Philippines (Schnitzler et al. 1999); in Tanzania, gender ratios in retailing vary markedly between cities, depending on religious affiliation (Yachkaschi 1997).

The different city case studies presented in this reader cover a range of situations in terms of gender involvement and influencing factors. There is no doubt that UA connects well with women's traditional childcare and general household management roles. It allows them to strengthen food provisioning and work close to the home. Most women urban producers are probably engaged in self-provisioning to a larger extent than men (Hovorka 1999). UA is particularly significant for women with larger families to feed and/or support (Dennery 1996, Maxwell 1995). There is evidence that UA can give women greater control over household resources, budget, decision-making and benefits. Many re-invest their savings into their children's education, into small upstream (bulk purchase and retail trade of manure, Haiti) or downstream (food processing and street vending, Nairobi) UA enterprises, as well as into other small businesses (Dennery 1997, Chauca 1999, Moustier 1996).

Figure 5: Classifying Urban Producers Criteria

- City zone
- Site location
- Tenure modality
- Socio-economic status
- Production system
- Scale of production
- Time allocation
- Product destination

Classifications of UA production systems/producers are many (see Figure 5). They reflect a combination of production factors, which characterise important segments of UA in any given city: city zones, site locations, tenure modalities, producers' socio-economic status, production systems and scales. Criteria (or combinations thereof) which seem to prevail are: zonal location within the city, modality of access to land, producers' dedication of time and other inputs, and product destination. Some studies have focused on specific categories, such as production systems based at home (Lee-Smith et al. 1987, Chauca 1999) and at open-space locations (Freeman 1991, ENDA-ZW 1997, del Rosario 1999). Others have developed classifications for specific production systems, such as market vegetable (Abutiate 1995, Centres 1991) or animal husbandry production (Centres 1991, Chauca 1999). In Kumasi and Lomé (Abutiate 1995, Kouvonou et al. 1998), vegetable producers are classified according to time dedication, including three subclasses of part-time producers (urban night-security men, artisans, periurban absentee farmers) and full-time and year-round producers (hiring labour). In Bissau, Lourenço-Lindell (1995) differentiates types of UA based on product destination: subsistence (self-consumption) or market-oriented. More elaborated classifications are based on a combination of tenure modality, time allocation and product destination, for Kampala (Maxwell 1995) and Accra (Zakariah et al. 1998); similar criteria were used by Sumberg (1999). Policy may benefit or affect the future of urban producers, depending on how they account for and intervene on those criteria, according to which particular groups of producers differentiate themselves from others.

3.1.ii How producers gain access to and use urban land

Producers gain access to urban land from a variety of urban actors, through diverse modalities of tenure and usufruct; arrangements are very often informal and sometimes based on customary law. In surveys available, those gaining access to tracts of land against the will of their owners are a very small minority.

Given the constraints on access to, and on the size of, land plots available for UA at any location, production systems are very diverse in order to make the most and the best use of particular locations within the urban fabric. Areas used are of all sizes, from tiny home spaces (windowsills, containers, fences, rooftops, basements, walls) to recreational grounds, utility and transportation rights-of-way (stream or roadsides), to suburban public or private estates.

Urban farmers may use different spaces in a complementary way over a period of time. For instance, year-round homegardens often serve as nurseries for rainfed off-plot fields, as in Lusaka (Drescher 1996); the same streamside field may carry vegetables in the dry season and grain crops in the wet season. Working several fields at different locations maximises access to critical inputs (stream water and effluents) and to niche markets (ornamentals at crossroad intersections, herbs across from catering facility, etc.), ensures stability against eviction from any particular site or against crop losses because of theft or other hazards.

UA management involves deciding which types of products and what scales of operation should be allowed in different parts of the city. A city may want to avoid major concentrations of stall-fed dairy cattle or piggeries in central districts, where it may encourage systems integrating stacked small livestock with space-intensive high-valued crops. Even in areas where public open spaces are in short supply, tenure agreements are being sought between urban producers and owners of private or public estates with idle areas (hospital grounds in Lima, golf club in Harare, schoolyard in Santiago, Chile, ocean port grounds in Lomé, etc.).

3.1.iii Promoters – managers

Various NGOs, governments and international agencies have been supporting UA activities in less-developed countries (LDCs) since the 1970s. NGO initiatives in UA have been very diverse since the 1970s, in all major world regions, and inventoried in a number of publications (i.e. worldwide: Wade 1987, Smit 1996; on Canada: Lifecycles 1998). NGOs have been active particularly in Latin America and the Caribbean (Prudencio 1997) and less so in Africa and Asia, where more NGOs traditionally focusing on rural development are now extending into urban areas. In urban areas, more NGOs have been seeking the collaboration of governmental actors to upscale local UA interventions, such as ENDA-ZW in Harare, Zimbabwe, CEARAH-Periferia in metro Fortaleza in Brazil, CARE Haiti in Port-au-Prince, Haiti, FUNAT in Havana, Cuba, REDE in Lima, Peru, etc. Few evaluations of NGO initiatives in UA are, however, available and more are needed to orient future interventions in collaboration with other actors (Chauca 1999, Régis 1999, Mougeot 1999b).

Examples for official promoters/managers of UA are:

National and local political leaders' public appeals for self-reliance: In countries as diverse as Tanzania, Zambia, Cuba, the Philippines, Guinea Bissau and Indonesia, presidents and mayors have called on urban and rural citizens to become more self-reliant in food.

Provision for UA in city master plans: New capital cities, such as Doala in the Ivory Coast and Dodoma in Tanzania, have been designed to accommodate UA. Agriculture has been incorporated into urban expansion plans for Kinshasa, Dar es Salaam and Maputo.

Revised urban regulations: Bylaws have been revised to allow for specific production systems in specific zones and state agencies have been authorised to promote appropriate practices in such areas, as in Kampala (where roaming cattle is still prohibited) and Kumasi (Atukunda 1998, Abutiate 1995). Dar es Salaam is one of the most elaborate bodies of legislation on UA in Africa; multi-stakeholder surveys have been used to suggest priority improvements to both text and enforcement (Sawio 1998).

New institutional mechanisms for UA: Several countries have created permanent institutional programmes and agencies. These have exploited flexible zoning modalities (Cruz 1999 and Gonzales 1999 on Cuba), purpose-specific leaseholds (Argentina), promoted UA to supply national school-catering programmes (Costa Rica) and legally organised groups of urban farmers (Zimbabwe, Tanzania), entitling them to credit and technical assistance. The Cuban Ministry of Agriculture has created an Urban Agriculture Office for Havana (Altieri et al. 1999) and the Philippino legislation enabled the Cagayan de Oro City Government to establish the City Agriculture Office, now responsible for all UA matters (Potutan et al. 1999).

Allocation of municipal open space: Organised groups have been assigned undeveloped public arable land for fixed periods of time (Harare and Gweru in Zimbabwe), and UA has been tolerated as interim or permanent land use in public-housing schemes (Dar es Saalam). In Havana, some 19 ministerial resolutions now protect urban areas under agricultural production. Following decentralisation of food production and release of state-owned land to temporary production in the 1970s, private farms in the late 1980s were supplying Sofia with 48% of its milk and eggs, 53% of its potatoes and about 50% of its vegetables. In Cagayan de Oro, the City Council has issued an initial ordinance allowing urban farmers to use parts of idle land and open spaces.

Officially promoted UA projects: In Bissau, where municipal urban regulations do not oppose UA (except roaming cattle), the Federal Government initiated with UNDP a Greenbelt Project which, in the early 1990s, benefited over 2000 cultivators, mostly women, in 14 urban districts (David & Moustier 1993). In Ghana, the Ministry of Food and Agriculture has introduced periurban milk collection to encourage periurban dairying in the Accra-Tema municipality (NRI 1995). Brasilia D.F. furthers the integration of small-scale food production with local food processing and marketing (de Carvalho 1999).

Direct public engagement in UA production: National or metropolitan public utilities have leased out land (Brazil), entered in partnership with producers (Senegal) or have become direct producers themselves (Tunisia, South Africa). In Havana, rather than producing it itself, the Ministry of Agriculture is now servicing and acquiring from individual small livestock producers a growing share of the basic meat supply for the city population and businesses (Jorge Luis Castellano, 13 October 1999).

International agency support to public UA interventions: Bi- and multilateral development agencies have been supporting more UA actively since the late 1980s: CIDA (Canadian International Development Agency) and GTZ (German Technical Assistance) have supported UA as productive use of metro green belts (Havana and Maputo), SWEDEPLAN has assisted with the inclusion of UA in the design of social housing (Maseru, Lesotho); NEDA has encouraged UA as productive open-space use near high-density residential areas; DANIDA (Danish International Development Agency) has funded fuel wood plantations and credit to female producer co-operatives; SIDA (Swedish International Development Agency) recently funded an East African workshop to inform policy research into rural-urban food production and is currently considering UA as part of a new urban environmental management programme in SE Asia (Bo Gohl, 12 October 1999). French Co-operation has supported market assessments for specific commodities (periurban vegetable crops). United Nations Development Programme (UNDP) and the UN's Food and Agriculture Organisation (FAO) have been providing technical training and feasibility studies for several production systems. UNCHS has supported formal consultations of UA as part of multi-stakeholder action plans for urban management. UNICEF and related humanitarian NGOs such as CARE, OXFAM and CEBEMO (Dutch Catholic co-financing organisation) have supported UA projects. The World Bank, (WB), the International Development Research Centre (IDRC) and the European Union (EU) have supported treatment and reuse of liquid and solid waste in periurban agriculture in Peru, Brazil, Chile and Cambodia (UNDP-WB Water Sanitation Programme guidelines). The WB recently supported projects recommending inclusion of UA as legitimate land use in new city master plans, such as in Uganda; it also commissioned an assessment for comprehensive WB support to UA in SSA (Smit et al. 1996a). FAO has formalised an inter-departmental group and will lead, with ETC Netherlands and UMP (Urban Management Programme of the UNDP), a series of electronic conferences aimed at national and local authorities to identify policy assistance needs on particular UA issues.

3.2 Why is UA important?

This section will provide a brief overview of the external functionality of UA. The issues addressed here are further explored in the thematic articles that follow this introduction. Furthermore, the city case studies provide specific examples for the different function of UA.

UA is one source of supply in urban food systems and only one of several food-security options for households; similarly, it is one of several tools for making productive use of urban open spaces, treating and/or recovering urban solid and liquid wastes, saving or generating income and employment, and managing freshwater resources more effectively.

Today, Smit et al. (1996b) claim that an estimated 800 million people are engaged in UA worldwide; of these, 200 million are market producers, employing 150 million people full-time (Smit et al. 1996b). Denninger et al. (1998) estimate that nearly 25 out of the 65 million people living in urban areas of Eritrea, Ethiopia, Kenya, Tanzania, Uganda and Zambia currently obtain part of their food from UA and that, by 2020, at least 35-40 million urban residents will depend on UA to feed themselves.

Data on several production systems show dramatic growth in numbers of producers, production systems at work, area used, production and yields in several cities. Both output and yields have increased, despite area reduction in market vegetable gardening in Dakar (Mbaye 1999, de Bon et al. 1997). Similar trends are observable in Kumasi (Abutiate 1995) , Lomé (Kouvonou et al. 1998) and in local and export specialty crops in Bissau (Lourenço-Lindell 1995). As in Singapore and Hong Kong years ago, Havana and Cagayan del Oro are now witnessing the expansion of small-livestock systems relative to plant crops.

On the urban food-supply side, crop choices, agricultural credit programmes and incentives, technical extension and research, and distribution networks often have been dictated by export and hard-currency earning policies. Official control of food prices has favoured urban wage earners and discouraged rural production. Subsidies are less frequent today, but their removal often exacerbates price seasonality; high transaction costs may discourage rural producers from supplying critical markets; institutional frameworks may not be in place for markets to operate effectively. Economic liberalisation also has made some urban-based productions more competitive than rural counterparts and has opened up an urban market for local input and implement suppliers; export-oriented crops have even become viable in urban areas (Accra, see Zakariah et al. 1998; Bissau, see Lourenço-Lindell 1995).

On the urban food demand side, devaluated currencies, weakened purchasing power, frozen wages, retrenched public service and formal employment, and removed subsidies on food and other basic needs have curtailed the capacity of both the urban poor and middle class to purchase all the food they need. In 1990, households in nearly half of the largest cities in low-income countries were already spending on average 50-80% of their income on food (PCC 1990). This figure was higher for low-income households; even so, their purchases often have been found not to cover daily minimum requirements. No matter how efficient the urban food supply market may be, rapid urbanisation and growing urban poverty will complicate the demand side of the equation for decades to come. Where periurban production and marketing systems are considered to be efficient, as in Port-au-Prince, the retail price of local vegetables makes them simply unaffordable by the poor (Sumberg & Kleith 1994).

In this context, governments are awakening to one undeniable and gathering trend, but need to better cope with its far-reaching economic, social and political underpinnings: poverty and malnutrition are becoming increasingly urban. More of the rural poor are migrating to the cities, more of the people in cities are being born in poor families and more urban middle-class residents gravitate around the poverty line. If in 1988 at least 25% of the developing world's absolute poor were living in urban areas, by year 2000 these are expected to comprise 56% of the world's poor households (WRI/UNEP/UNDP/WB 1996; UNICEF 1993).

The importance and diversity of UA systems in any given city seems to depend on multiple factors at levels ranging from:

- global (international trade); to
- national (level of development, fiscal/ financial structural adjustment, disasters, agricultural policies); to
- regional (urban food supply system, prevailing agroclimate, strength of agricultural and food traditions); to
- urban (population growth and densities, physical layout, employment levels, consumers' tastes and market niches, legislation); to

- district within the city (urban vs periurban, low vs high income, low vs high densities, residential vs other uses); to
- household (size, dependency ratios, income levels, gendered responsibilities); and to
- individual (education level, particular mix of occupations, farming skills, access to resources, contacts with suppliers/clients).

3.2.i Nutritional benefits

Self-produced food in cities provides nutritious food otherwise unaffordable (all animal protein in low-income households of El Alto, Bolivia), replaces purchased food staples or supplements these with more nutritious foodstuff, affords savings (as much as 20% of income) which can be spent on non-produced foodstuff or other needs (school fees, transportation), and/or generates supplemental or principal income which can be reinvested in other urban businesses (sewing machine, typewriter, kitchen appliance). Self-production represents anywhere from 18% (East Jakarta) to 60% (Kampala) of total food consumption in low-income households, with sample percentages depending solely on self-production reaching 50% (Nairobi) (Mougeot 1994). In Harare, savings accruing to low-income farmers are equivalent to as much as several months of earnings (ENDA-ZW 1997). In Havana, urban gardens have significantly increased the quality and quantity of food available to the producers' households and their neighbourhood, improved the financial welfare of the households and enhanced the environmental quality of the community (Altieri et al.1999).

From an intervention viewpoint, non-food production may be the way to improve the income and nutritional status of households, depending on prevailing local constraints and opportunities. As Cox (1999) verified in the case of El Alto, Bolivia, severe water scarcity, the emphasis on exotic vegetables and the local plant demand for beautification had women participating in NGO projects abandon original community vegetable gardens in favour of more profitable tree and ornamental nurseries. Exclusive emphasis on food production may be less effective in improving nutritional health, where local food preparation and cooking practices should be corrected or the social status locally associated to particular foods should be accounted for, as verified in Dar es Salaam (Kogi-Makau 1995).

3.2.ii Impact on community welfare

The impact of UA on urban community welfare is more documented than the impact on the rural counterparts. In low-income urban districts of Bissau, Brazzaville and Nairobi, urban farmers contribute to community welfare and funeral groups and to formal and informal channels of food acquisition. They generate employment and additional or seasonal income for other basic needs (processed food), link up with the food trade, produce food products otherwise unaffordable, reduce dependence on purchased food, enhance their own exchange entitlement and provide food gifts and meal sharing (Laurenço-Lindell 1996, Moustier 1996, Dennery 1996). In Bissau and Port-au-Prince, the frequent gifting of food by home producers strengthens reciprocity within assistance networks and reduces incidence of theft. Open-space producers also unwillingly contribute to curbing food insecurity through loss of crops, animals and other assets to theft, commonly reported in surveys (Lourenço-Lindell 1995, Régis 1999).

As to rural and urban incomes from market agriculture, in Bissau urban vegetable producers' margin of profit is larger, thanks to direct marketing by the producer; but volumes traded individually are small and corresponding incomes are only a fraction of those of rural traders. A similar principle applies to urban producers of fresh milk. The atomised structure of the production-trade network of UA has major benefits for both the producer and the consumer, which have been largely underestimated, when not openly discouraged, by attempts to dictate price controls and centralise collection and processing. Most attempts have been successfully resisted by the larger part of UA and will continue to be so, until more decentralised strategies are implemented which will safeguard and enhance such benefits.

3.2.iii Interdependence with rural agriculture

UA tries to complement supplies from rural areas and should be supported to do so. David and Moustier's (1993) study of the vegetable-supply system of Bissau showed that urban production promoted by the government to diversify and buffer the seasonality of supplies to the city has been truly complementing other (rural and foreign) sources. West African cities also frequently offer better conditions for breeding, sheltering, watering or fattening livestock otherwise kept in rural areas (Centres 1991). Stevenson et al. (1996) found that the urban, periurban and rural zones complemented each other in supplying specific produce to the city of Dar es Salaam. Tomatoes, African eggplant, cabbage and onions come from rural locations; eggplant and okra from periurban; sweet pepper from urban and periurban; and hot peppers from periurban and rural locations. In India, both the inability of rural production to meet the growing urban demand for poultry products and the continuing relocation of traditional food processing to urban areas concur to explain the long-term proliferation and intensification of periurban poultry systems in that country (Panigrahi 1995). Overall, this two-way flow of knowledge, resources and goods for specific productions, and its impacts on both rural and urban communities, remain largely undocumented; such information is needed to devise socially acceptable and economically viable local food systems.

4. Main doubts and risks raised by UA

Little could be found in the academic literature which would condemn UA at large and advocate its ban under any form. The debate is likely to heat up as UA practice and policy grow in scale and in complexity in the next decades, thus affecting interests in very different and tangible ways. Some have argued that greater public support to UA in large cities would fuel rural-urban migration, while several surveys show that most migrants to large cities come from smaller cities and not from rural areas. The surveys further suggest that migrants arrive in the cities with the initial ambition to work in anything but agriculture and that a majority of urban producers are not recent arrivals. Others have contended that public support to UA could significantly reduce public investments in rural agriculture, while UA needs intersectoral co-ordination of current financial flows much more than major new funding. There is a gathering perception that, in an increasingly urban world, development challenges – among which poverty and hunger reduction – will not be met unless holistic agricultural policies tap on urban and rural complementarities, rather than ignoring them.

4.1 UA hampers urban development?

The more frequent argument from urban planning is that agriculture should be confined to rural areas, as it can interfere with more productive use/rent of land by other economic activities.

Yet, different UA systems do combine with a range of non-agricultural land uses; for instance, the Centre for Urban and Rural Studies of the Universidad Catolica Madre y Maestra in Santiago de los Caballeros, Dominican Republic (del Rosario 1999) found that in 1997 food crops and livestock were being produced in a third of all 2734 city blocks (38% of the blocks classified as poor, 24% of low-income, 44% of mid-income, 48% of high-income residential, 6% of commercial, 15% of industrial and 23% of institutional).

4.2 UA threatens public health?

Such concerns refer to contamination risks of producers, handlers, consumers and people in the vicinity of production areas caused by crop and husbandry inputs, products and by-products (nuisances, safety hazards). These concerns are legitimate and must be addressed; they arise from practices carried out at wrong places or in the wrong way; they have to do with the quantity and use of agricultural inputs (including feed), choice of production for site characteristics, density of use of site and vicinity (number of animals per unit area), handling of products and by-products.

Particular attention must be given to human health risks and nuisance posed by urban livestock. Flynn (1999) states that the relationship between UA and the rural-urban transition of zoonoses remains largely under-researched. There is evidence from major cities in Nigeria, India, Brazil and Saudi Arabia on human brucellosis infection and echinococcus infection transmitted by domestic livestock. The risk of such diseases spreading is real, as a result of inappropriate zero-grazing and animal-waste disposal in slaughterhouses or densely-populated areas, where space-confined husbandry of swine, goats and sheep is growing (Ayanwale et al. 1982, Pillai et al. 1996, Larrieu et al. 1988, Cooper 1991).

Health aspects of human excreta re-use have been extensively reviewed by the former International Reference Centre for Waste Disposal (1985); a comparative study of 1989 WHO (World Health Organisation) guidelines for wastewater/excreta re-use confirmed their appropriateness (Blumenthal et al. 1991/92). Problems seem to reside with implementation and acceptance. Chinese cities have a long tradition of collecting human wastes and applying “night-soil” to periurban crops, although Ling (1994) argues that treatment processes have yet to be standardised to reduce potential health risks posed by the use of human waste as crop fertiliser or fish feed.

4.3 UA has negative environmental impacts?

Environmental health issues include visual untidiness, soil erosion, destruction of vegetation, siltation, depletion of water bodies and pollution of resources (soil, air, water).

The use of agrochemicals in UA is one source of concern. Depending on the intensity of UA production, their use may vary extremely. Whereas UA for self-consumption relies less on the use of agrochemicals (Lourenço-Lindell 1995), more intensive market production might make excessive use of certain products, as observed in Bamako and Lomé.

De Bon et al. (1997) in Dakar and Kouvonou et al. (1998) in Lomé found that market vegetable farming makes more extensive use of organic than of mineral fertilisers, thereby giving value to sub-products of animal husbandry. In Cuba, the use of chemical fertilisers is prohibited within city limits and producers rely on integrated pest management and organic soil management (Altieri et al. 1999).

Lewcock (1995) found in Kano, Nigeria, that periurban farms are a traditional informal and growing market for large quantities of minimally composted waste; he also found that these producers lacked knowledge on the safety of waste materials for use as fertiliser or stock feed. Few cities outside Asia sell and deliver truckloads to large clients on the urban fringe, or encourage at-source sorting and pre-collection of organic waste by organised groups for local composting and UA use. In Egypt, compost was found to be severely contaminated with heavy metals because of poor sorting of inorganic waste (Lardinois & van Klundert 1994).

In most developing countries, municipal solid-waste management remains centralised, capital-intensive and deficit-ridden. Yet, in several African cities, neighbourhood and micro-enterprise composting has been effective. At-source sorting and doorstep collection is crucial to increase usable volumes and improve the safety and acceptance of organic waste use in UA.

4.4 UA is not very profitable?

Data available from various sources for several LDC cities indicate that UA makes an important contribution to employment and income generation. In the early 1990s, agriculture provided the highest self-employment earnings in small-scale enterprises in Nairobi and the third highest earnings in all of urban Kenya (House et al. 1993). However, studies are rare which try to systematise the economic contribution of UA at city level. The Mazingira Institute estimated the total worth of on-plot crops grown in urban Kenya at USD 4 million in one growing season of 1985. Freeman (1991) estimated the value of Nairobi farmers' 1987 annual (two-season) off-plot crop production alone to be USD 4 million.

The UA up- and downstream effects on the rest of the urban economy has not been quantified. UA requires inputs and human resources for fencing, crop management, storage, transportation and processing (milling, cooling, drying, cooking, packaging). Income from UA is used to buy processed food, appliances, clothes, and services and can be invested into other small businesses.

5. Conclusion

Smit et al. (1996b) very ably summarized the main risks and benefits, constraints and opportunities which can be posed by and to UA in any particular context; in principle, all are susceptible of meriting some form of policy intervention. The question to this paper is to short-list those policy needs which represent the main "challenges" ahead. Given the literature review, this paper discussed those aspects of UA which currently raise the more important policy "challenges", in other words, issues where there persists clearly a discrepancy between the perceived urgency of interventions and the lack of experience on record to do so. This is why the paper discussed a limited number of issues (food security, land access, gender implications, land use dynamics and urban planning, public health and sanitation, environmental impacts, interaction with RA). The paper cannot claim to treat such challenges comprehensively; fortunately, a very large number of references used for this paper do contain some policy analysis dealing with particular UA systems in intra- and periurban zones, relevant sectoral support needs, governmental levels involved and problem focus (from land provision to marketing).

Still, it is probably fair to say that most recent policy analysis comes from agricultural circles, much less so from urban planning sectors. Without overlooking the critical contribution of the former, the latter is even more fundamental to UA's adequate integration into the urban economic and ecological system. Earlier this year, Canadian Institute of Planners awardee Soonya Quon (1999) reviewed the international literature and surveyed in writing and orally some 26 urban planning professionals from 18 cities around the world, on tools and strategies for urban planners to incorporate UA into city planning, including responsibilities and limitations of urban planners. Opportunities to account for UA include: input to municipal plans and planning policy, use of tools and strategies to realize planning goals (zoning and zoning by-laws, urban land databases and urban baseline studies, environmental impact assessment, public capital investment, subdivision control, economic and other tools.). Urban politicians have been more accommodating of UA than urban planners have been for-sighted about it. Urban governments need to listen to their planners and these need to evolve a concept of the city more fitting with local reality. Quon also found that, beyond planners' competence and willingness, the planning policy context in which they operate may be inimical to UA, as a result of a lack of awareness of the socio-economic and environmental role of UA, a lack of clear government responsibility, resistant attitudes or cultural norms held by parties in the land use planning process, and a lack of resources, technical and financial support. Quon's recommendations include: changes to land use planning policy to recognise and support UA; recognition of UA through land use zoning with UA being primary or tertiary land use; measures countering the potential negative health and environmental effects of UA activities; new multi-disciplinary institutions responsible for UA, records of UA and of land use and land tenure in communities; education to overcome ingrained attitudes against farming in cities held by various parties in the planning process.

Policy challenges regarding the issues discussed in this paper must be tackled through interventions involving actors working at different levels. Smit et al. (1996b) have proposed a list of interventions in information and research, projects, access to services and resources, policy and planning and cooperation; they indicate in each case which levels of intervention should be involved, for greater effectiveness. The following paragraphs highlight those types of interventions from Smit et al.' (1996b) which should merit a relatively greater policy effort by actors involved at each of the four levels identified by Smit et al.: community, city, national, international.

At the community level (e.g.: city district), good progress has been made to integrate UA into ongoing projects and activities of community development, including environmental regeneration. The more effective and lasting interventions are those that are perceived by the community as assisting with solving key community problems, that actively engage local actors into design and implementation and that strengthen local capacities for pursuit. At this level, more experiences in the North could act as useful references to incorporate UA into local food systems of the South, largely through developing communities' capabilities in this area (Dahlberg 1999; Hamm & Baron 1999). Also, more surveys are being conducted to document UA and inform local institutions. Such surveys are more effective when driven by issue resolution through multi-stakeholder processes, where research alternates with policy formulation for practical interventions (e.g.:

Dakar, Harare and Dar es Salaam in Africa); the participatory dimension of such experience is being emphasized in new models (e.g.: Spies 1998; van der Bliek & Waters-Bayer 1996). A range of modalities to improve access to resources, services and inputs, as well as security, have been experimented worldwide, largely through innovative partnerships between key actors. However, much less has been done for providing training in good practice or for assisting urban producers in establishing representative and effective organizations. National and international actors in both the governmental and non-governmental arenas share responsibility in this regard.

At the city level, several urban centers have initiated or completed background studies and discussions for designing or adopting regulatory or promotional policies on UA. Several also have adopted enabling legislation or recognized agriculture as an urban industry. Many more have supported disadvantaged citizen groups. However, much less progress has been recorded in taking stock of that wealth of experience, and in creating institutional structures to implement UA policies; even fewer cities have created city-level food system plans embracing both rural and urban sources. Maxwell (1999) argues that the relative invisibility of urban food security as a political issue in Africa may be due to governments still perceiving this as a household-level responsibility. Pothukuchi & Kaufman (1999) recently examined city institutions that can address more comprehensively urban food systems, such as the city department of food, the food policy council and the city-planning department. Outside Asia, the developing-country experience with citywide integration of the waste management system with the food system is very limited; this includes the use of UA to achieve environmental sustainability. Land use plans and regulatory systems still need to be designed and implemented that promote access to land, water and markets for urban producers; the same can be said of public and work safety programs. At the national level, little progress has been made for setting up national UA or food policies, even though these can greatly influence city-level policies. There are very few national food policies outside Asia that establish synergies between rural and urban production systems and guide urban-agricultural integrated programs. Northern countries' own governments are increasingly being criticized for having agricultural/production policies instead of genuine food policies (Allen 1999; MacRae 1999); the de-politicization of food is contributing to the lack of data, understanding and policy on local food systems (Dahlberg 1998). The application of U.S.A.'s Community Food Security Act to urban community agriculture projects since 1996 is a step in the right direction and may provide a useful reference (Pothukuchi & Kaufman

1999), as well as growing public lobbying for a healthier food policy in Britain (Lang, 1999). Several agricultural departments do extend technical extension to urban areas; this should be adapted, through research and training, to urban conditions and needs of urban farmers (women). There is a good range of experiences with economic incentives (tax alleviation, input subsidies), but much less on model health and land use codes, despite creative partnerships known to have facilitated access to land and water areas.

At the international level, the development of agreements on common research methods is very recent; model codes still need to be developed as a basis for national and city regulatory programs. Very few projects on record have been thoroughly evaluated for lessons to inform models that could assist local agencies with introducing improved UA practices. Comparatives studies of the industry's performance are also lacking, across cultures, climate zones and levels of development and city sizes; these are needed to better advise governments. Hardly any systematic effort has been expended so far to document, evaluate and propose models of effective urban producer organizations. Regional and global networks are developing but these have had a limited impact so far in the creation of national and local networks.

In conclusion, while prohibitive policies are bound to be ineffective, several constraints and risks are clearly associated with non-regulated UA; also, conflict, corruption and competition for scarce resources do exclude from legal UA those who stand to benefit most from it. Clearly, a permissive approach to policy-making would not address these problems and in fact could defeat its well-intended purpose. The tendency of local governments is to move beyond accommodation and into issue management (see Mougeot 1999a). From the experience reviewed, multi-stakeholder governance may still be local governments' best way of managing, if not resolving, such issues. More authors have been calling for a re-regulation of urban food systems and for UA policies to target vulnerable groups, in order to effectively strengthen local sustainability and equity (Smith, 1998; Lee-Smith 1998; see Koc et al. 1999). To be effective, such policies probably will need to include measures that enhance equity and entitlement to food and other resources, that improve urban environmental/sanitation systems managed by the urban poor in their own neighborhoods, and that actively involve urban producers in ranking their problems, developing workable solutions and self-regulating their activities and the quality of their products.

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URBAN AGRICULTURE AND SUSTAINABLE CITIES

Tjeerd Deelstra and Herbert Girardet

1. Introduction

At the end of the 20th century, humanity is involved in an unprecedented experiment: we are turning ourselves into an urban species. Large cities, not villages and towns, are becoming our main habitat. Urban growth is changing the face of the earth and the condition of humanity. In one century, global urban populations have expanded from 15 to 50% of the total, which itself has gone up from 1.5 to nearly 6 billion. The size of modern cities in terms of numbers as well as physical scale is unprecedented. In 1800, there was only one city with a million people, London. By 1990, the world's 100 largest cities accommodated 540 million people and 220 million people lived in the 20 largest cities, mega-cities of over 10 million people, some extending to hundreds of thousands of hectares.

Urban agglomerations and their resource uses are becoming the dominant feature of the human presence on earth, profoundly changing humanity's relationship to its host planet and its ecosystems. The cities of the 21st century are where human destiny will be played out, and where the future of the biosphere will be determined. It is unlikely that the planet will be able to accommodate an urbanised humanity that continues to draw upon resources from ever more distant hinterlands, or which uses the biosphere, the oceans and the atmosphere as a sink for its wastes at the current accelerating rates. The challenge faced is whether cities can transform themselves into self-regulating, sustainable systems - not only in their internal functioning, but also in their relationships to the outside world. Is it possible to make a world of cities viable in the long term – socially, economically, as well as environmentally? The answer to this question is critical to the future well-being of the planet, as well as of humanity. There can be no sustainable world without sustainable cities.

1.1 Cities and the environment

Many of today's cities function very differently from those we have inherited from history, and relationships with the environment are changing. Low transport costs, based on the ubiquitous use of fossil fuels and facilitated by substantial government subsidies for transport infrastructure, often make distances irrelevant – plugging cities into an increasingly global hinterland. The actual location of settlements is also becoming less important as global trade treaties come to determine the fate of national and local economies. Today, urban dwellers don't really live in a *civilisation*, but in a *mobilisation* - of natural resources, people and products.

The concept of an urban ecological footprint can be used to help illustrate how surrounding rural and natural areas are being affected by cities. Ecological footprint analysis assumes that every category of energy and material consumption and waste discharge requires the productive or absorptive capacity of a finite area of land or water (Wackernagel & Rees 1996). The sum of all land and water required to meet material consumption and waste discharge of a defined population is that populations' ecological footprint on the earth. This does not have to coincide (and often does not) with the populations' home region. Ecological footprint analysis reveals the growing competing demands on natural capital, and it also raises the issues both of equity and the long-term sustainability of production. By establishing the ecological footprint of different life styles, infrastructure, consumption patterns and certain densities separately, it is possible to develop strategies to reduce environmental impacts and the depletion of natural resources. Local Agenda 21 cities are required to list activities to reduce the ecological footprint, while at the same time increasing the quality of life for the inhabitants. Food supplies to cities are an important component of the footprint of cities and a key issue in this context.

1.2 Cities and food

Cities require vast areas of land for their sustenance and have come to depend on large amounts of food being brought in from outside the land area they actually occupy. London, for instance, has a surface area of some 160,000 ha. With only 12% of Britain's population, London requires the equivalent of 40% of Britain's entire productive land for its food. In reality, these land surfaces, of course, stretch to far-flung places such as the wheat prairies of Kansas and Iowa, the soybean fields of Mato Grosso, the orchards of France and Spain, and the tea gardens of Assam or Mount Kenya. But this global dependence of Londoners has never been a big issue. Food is there to be bought and enjoyed – the environmental impact of food supplies, including the energy required for food production, processing and transport, is rarely discussed.

However, today's retailing and food distribution systems, relying on motorised transport and, increasingly, airfreight exact a heavy environmental toll in terms of fossil-fuel use, air pollution and damage to wildlife habitats through road building (SAFE Alliance 1994). The largest land surfaces required for feeding cities in developed countries are for producing grains, and animal feed such as maize and soybeans to meet the demand for meat. As countries with huge population, such as China and India, urbanise, worldwide demand for land to feed cities will continue to grow. Sooner or later, cities that have come to take large-scale food imports for granted may need to consider reviving agricultural production in urban areas or the urban fringe to reduce the demand for land surfaces elsewhere.

1.3 Urban sustainability

In a world increasingly dominated by cities, the international community is starting to address the issue of *urban sustainability*. The process began in Rio with Agenda 21 and continued at the 1996 UN City Summit in Istanbul. The 100-page Habitat Agenda, signed in Istanbul by 180 nations, states: "Human settlements shall be planned, developed and improved in a manner that takes full account of sustainable development principles and all their components, as set out in Agenda 21. ... We need to respect the carrying capacity of ecosystems and preservation of opportunities for future generations. … Science and technology have a crucial role in shaping sustainable human settlements and sustaining the ecosystems they depend upon."

It is recognised that cities nowadays use too many natural resources and produce too much waste. The ecological footprints of cities are stamping out the habitat of many species. The city's impact stretches far beyond its physical boundaries. Moreover cities are confronted with an increasing number of people and, therefore, an increasing number of mouths to feed. Along with other initiatives and activities, urban agriculture therefore has an important role in contributing to the future sustainability of cities.

2. Urban agriculture

2.1 Farming in cities today

Despite their inherent density, cities do have enormous potential for food growing. Smit et al. (1995) reported that:

The 1980 US census found that urban metropolitan areas produced 30% of the dollar value of US agricultural production. By 1990, this figure had increased to 40%. There are 80,000 community gardeners on municipal land in Berlin with a waiting list of 16,000. Singapore is fully self-reliant in meat and produces 25% of its vegetable needs. Bamako, Mali, is self-sufficient in vegetables and produces half or more of the chickens it consumes. Dar-es-Salaam, one of the world's fastest growing large cities, now has 67% of families engaged in farming compared with 18% in 1967. Presently, 65% of Moscow families are involved in food production compared with 20% in 1970.

These are remarkable figures given the neglect of agriculture in urban planning policy. Planners tend to think that urban food growing is a messy business, and have little understanding of peoples' need to grow food in cities. But for hundreds of millions of urban people, it is a vital component of their livelihoods and during hard times it is an important survival strategy, and city dwellers are increasingly trying to persuade planners to give them space for growing crops. This is true not only in developing countries, but also increasingly in the developed countries, particularly in cities where unemployment is endemic. In addition, many people like to spend part of their time growing things as a leisure pursuit.

In times of crisis, like war or recession, growing food in cities has always been essential to urban people. *Schrebergaerten* were started In Germany after the First World War, when city people had the choice to go hungry or to grow some of their own food. In the Second World War in Britain, the Dig for Victory campaign brought much urban land into cultivation. Today we face a new kind of crisis: chronically high levels of unemployment are a growing concern in some cities, forcing many people to adapt or adopt new survival strategies, including spending some of their time on growing food.

Urban agriculture therefore contributes to the sustainability of cities in various ways – socially, economically and environmentally.

2.2 Farming in cities and ecology: constraints and opportunities

In this section, we concentrate on the major environmental constraints associated with urban agriculture and its potential role to help improve the ecological performance of cities. One of the major constraints is obvious: the lack of space in cities for growing food. However, there are several advantages and opportunities to improve the environment and ecology of cities. Urban farming can help to create an improved microclimate and to conserve soils, to minimise waste in cities and to improve nutrient recycling, and to improve water management, biodiversity, the O_2 - CO_2 balance, and the environmental awareness of city inhabitants.

2.2.i Space for growing food

In the western world since the Second World War, few provisions have been made for space for urban food production. The economic boom of the last 40 years has led to the assumption that city people will *buy* food, not *grow* it themselves. But at a time when work sharing is widely seen as essential for assuring a dignified existence for large numbers of people, additional opportunities for people to create livelihoods for themselves are essential. Urban food growing is certainly one of the options.

In cities that have experienced industrial decline, provision of derelict land for food growing is certainly a planning policy option. In American cities such as Detroit and New York, thousands of acres of land have been given over to unemployed workers for food growing. In Britain, city-farm projects have been established on areas of derelict land in some 20 cities. In Germany, land in former coal-mining areas in cities such as Essen is being set aside for urban agriculture projects.

There has been concern about the suitability of contaminated urban land for food growing, and it has been suggested that it is prudent not to grow crops less than ten metres from busy roads, particularly in countries where lead fuel is still in use. Generally, land polluted by heavy metals, such as cadmium and lead, requires special precautions. However, research in the USA and the UK has shown that these problems can be tackled in a number of ways: firstly, maintaining a high pH with additions of plenty of lime, and high organic matter levels through additions of compost or manure helps to immobilise heavy metals in the soil.

The Chinese are famous for their highly intensive urban cropping systems and, to this day, many of their large cities are largely self-sufficient in food produced on *adjacent* land areas administered by them. Beijing, now a city of over 10 million people, still administers its own adjacent farmland extending to an area the size of Belgium. In Shanghai, only 20% of the land administered by the city authorities is actually built on; 80% of the land, mainly in the urban perimeter, is used for crop growing, making the city region self-sufficient in vegetables and producing much of the rice, pork, chicken, duck and carp. With their unique system of governance, Chinese cities administer vast adjacent areas of farmland and aim to be self-sufficient in food from this. Is this model of urban-rural linkages relevant to cities elsewhere in the world?

In many cities there are areas which are less suitable for housing, and often offer excellent positions to produce food. Dar es Salaam in Tanzania provides a good example. The city has a spacious urban pattern and many areas near the rivers are not suitable for housing, because of regular flooding in the rainy season. These areas are well suited, and well used, for growing food.

2.2.ii Microclimate improvement

If appropriately planned and integrated into urban design, urban agriculture can contribute to the comfort of citizens. Green spaces around apartment blocks and houses, as well as neglected spaces in the city, help to improve the physical climate because vegetation can:

help increase humidity, lower temperatures and introduce more pleasant odours to the city;

capture dust and gases from polluted air through deposition and capture by the foliage of plants and trees, and soils; and

help break wind and intercept solar radiation, creating shadow and protected places.

One good example is the city of Cairo, where air pollution has risen to dangerous levels. For this reason, urban green areas now have a high political priority. The Tree Lovers' Association aims to expand the green areas in Maeâdi. The Association takes charge of planting and caring for the trees in the location of the old canal in this district of Cairo. Another example is Sofia, the capital of Bulgaria, where growing of food around housing compounds, along riverbanks and in other vacant spaces where public green spaces have been neglected by the municipality has led to an increase in vegetation and an improved microclimate.

2.2.iii Conservation of urban soils

Creating fertile soil is not usually a problem in cities because, by definition, they are places where fertility accumulates in great abundance. There is little need to use chemical fertilisers, although in some cities like London, urban agriculture can also be highly chemical intensive. A great variety of materials are available that can be composted and incorporated into garden soil – crop residues, kitchen wastes, old newspapers, the leaves of city trees and even human faeces. The Chinese have long used a system of meticulously recycling and composting human and animal wastes, thus maintaining the fertility of their farmland by the most appropriate means. Whilst this system has been weakened in recent years, the Chinese are reluctant to abandon it altogether. Instead, they are exploring ways of upgrading sewage-recycling technology.

Urban farmers have always utilised the great variety of fertile materials they have found in cities. The best-known example is the vegetable growers in Paris who, until the end of the First World War, were famous for the abundance of their crops. They used to heap up to 0.3 m of horse manure on top of their vegetable beds every year, and used many different methods to control soil and air temperature. They were able to grow between three and six crops of fruit and vegetables a year, making a good living on no more than 0.75 ha. In Paris of a century ago, 100,000 tonnes of high-value out-of-season crops were grown on 1400 ha, around one-sixth of the surface area of the city, using about one million tonnes of horse manure. The crops were so abundant that they were even exported as far away as London. However, the introduction of motor-powered transport ended the supply of horse manure to the *marais*. In addition, more and more crops were brought in by train from the south of France.

Provided that organic amendments are not contaminated, the use of abundant fertile materials and the growing of trees, crops and other greenery in cities will help keep urban soils fertile. Natural soils are rich in life; there are numerous “recycling” systems at work in the top layers of the earth. Through urban agriculture, soil systems can be kept in balance. Examples of good practice can be found in Accra (Ghana) and Dakar (Senegal) where urban agricultural activities have shown a positive effect on stabilising the soil against water and wind erosion “Filao” plantation both hinders quick movement of sand through wind erosion and produces compost.

2.2.iv Waste and nutrient recycling

A key factor in urban ecology is the process of waste management and nutrient recycling. The *metabolism* of many traditional cities was *circular*, whereas that of most “modern” cities is *linear*: Resources are funnelled through the urban system without much concern about their origin and about the destination of wastes; inputs and outputs are treated as largely unrelated. Contemporary urban sewage systems are a case in point. They have the function of separating people from their wastes. Sewage, treated or not treated, is usually discharged into rivers and coastal waters downstream from population centres, and its inherent fertility is lost to the world’s farmland. Today, coastal waters everywhere are polluted both by sewage and by toxic effluents, as well as the contaminated runoff arising from use of fertilisers and pesticides applied to farmland growing food for the cities.

Justus Liebig, a pioneer of modern chemistry in the 19th century, took a close interest in the history of urban food production and studied the environmental history of ancient Rome. For two centuries, much of Rome’s grain supply was imported from North Africa, with a dramatic impact on the area's soil fertility. The minerals contained in the grain – nitrogen, potash, phosphate, magnesium and calcium – were removed from the farmland and, via Rome's Cloaca Maxima, flushed into the Mediterranean, never to be returned to the land of North Africa. Despite having studied Rome’s mistakes, most modern cities have repeated this pattern. In a letter to Sir Robert Peel, Prime Minister of the UK in 1840, Justus Liebig wrote:

The cause of the exhaustion of the soil is sought in the customs and habits of the towns people, i.e., in the construction of water closets, which do not admit of a collection and preservation of the liquid and solid excrement. They do not return in Britain to the fields, but are carried by the rivers into the sea. The equilibrium in the fertility of the soil is destroyed by this incessant removal of phosphates and can only be restored by an equivalent supply. ... If it was possible to bring back to the fields of Scotland and England all those phosphates which have been carried to the sea in the last 50 years, the crops would increase to double the quantity of former years.

When London's authorities decided to construct a sewage disposal rather than a recycling system, Liebig decided that it was necessary to find ways to replace the fertility removed by cities from farmland by artificial means. He set about developing artificial fertilisers to keep the land feeding cities productive. Today, the use of artificial fertilisers is the norm all over the world. The systemic problems inherent in this are well documented. For instance, coastal waters everywhere now contain both urban sewage as well as the runoff of mineral fertiliser applied to the farmland feeding cities. This is both a massive waste of nutrients as well as a major cause of eutrophication of coastal waters.

The linear metabolic system of most contemporary cities is unsustainable. It is profoundly different from the metabolism of nature's own ecosystems, which could be likened to a large circle: every output by an organism is also an input, which renews and sustains the whole living environment. Urban planners and educators should make a point of studying the ecology of natural systems. On a predominantly urban planet, cities need to adopt circular metabolic systems to assure their own sustainability and the long-term viability of the environments on which they depend. Urban *outputs* will need to be regarded as crucial *inputs* into urban production systems, with routine recycling and composting of organic materials for re-use on local farmland. Very up-to-date methods for recycling urban wastes into nutrients for urban and urban-fringe farming and gardening are now available to us.

Efforts for waste reduction require three different approaches: reducing the amount of waste, re-using what can be re-used, and recycling the remainder. Urban agriculture can play an important role in all three approaches. It can help to reduce the need for food packaging. Much of the packaging of food is cosmetic or its purpose is to get it safe and undamaged across long distances to its destination. Food-growing sites can be the repositories of much re-usable household waste. Old carpets, bits of polythene, wood, glass, rubber tyres and clothing may be used in production activities. Food growing also makes use of recycled materials. Organic waste accounts for 20% of household waste and, when composted, it can produce an excellent fertiliser.

The relation between urban agriculture and waste management is most pronounced in the use of organic wastes. Food production by livestock eating food remainders is a tradition in many Asian and African countries, but also in northwestern Europe. Observation of daily life in Hubli-Dharwad, India shows that keeping livestock in urban centres has some advantages, because there are sources of fodder, such as waste materials from hotels, markets and homes, and easily accessible markets for produce, particularly for fresh milk from urban dairies. The cycle of nutrients through the use of urban waste within Hubli-Dharwad (and in many other regions of India) is also a good example of urban-rural linkages. Such linkages include the sale of dung from cows, and the sale of market waste to rural farmers. There are a number of advantages for the Municipal Corporation arising from these informal waste markets. These include the removal of much wet organic waste from the streets and bins, the revenue from selling waste, creation of more space at the dumpsites, and the use of dung as a cooking fuel reducing the demand for fuelwood and liquid petroleum gas (LPG). Although keeping animals in an urban area does have disadvantages, it can serve a useful role in solid-waste management.

Farmers in Accra (Ghana) are also well engaged in solid-waste recycling (see case study). The waste generated from crop farming (dried vegetables) is recycled and used as mulch and compost to enrich the soil. Waste generated from livestock farming, such as cow dung and chicken droppings, is the main source of fertiliser for vegetable farming. Livestock is fed on leftover food from restaurants or “chop bars”. The skeleton waste from livestock is collected, cremated and processed into powder for feed and paints. In this way, re-use of wastes helps contribute to a well-functioning agricultural system.

2.2.v Water management

Agricultural activities in cities can indirectly improve urban water management, because green spaces with permeable land surfaces allow rainwater and runoff to drain through the soil. This is important because the growing areas of hard-covered surfaces in cities (e.g. streets, roofs and car parks) leads to increased volumes of runoff during storms, with risks of floods and landslides. The need for costly storm water sewers and drainage can be minimised when enough green space is available. To invest in urban agriculture, therefore, is just as necessary as developing a network of channels and drains.

The direct use of recovered wastewater for food production in cities can also improve the efficiency of water use – especially important in countries with limited water resources. Given the existing nature of most sewage systems, which combine wastewater with numerous pollutants, wastewater re-use requires significant investment in separation or treatment, and improved organisational capacity. Unfortunately, investments in water infrastructure and conservation measures are often not made because of unclear land rights. The case of Dakar, Senegal, however, demonstrates how a wastewater recycling system can be set up. There are two stations for the filtering of used water, combining collection points of solid waste to make compost. The recovered water is used to irrigate land. Recycling of wastewater is not without its problems though. In Cairo, environmental contamination of soils arising from use of untreated sewage water for irrigation is a serious problem.

Lack of water is a major problem to many, if not all, developing countries. For example, Hubli-Dharwad struggles as a result of a declining number of lakes and water tanks over the last 20 years, as the urban settlement has grown and tanks have been filled in and built over. Farmers in horticulture have responded to the shortage of water through the use of sewage water for the irrigation of vegetable crops. Wealthier farmers also often sink bore-wells to establish more secure water supplies, though this is inevitably affecting the water table of the area and the availability of water resources for other purposes.

Urban agriculture can also pose serious risks to water resources, for example, by leading to increased pesticide levels in groundwater. To reduce risks of pollution, in Cagayan de Oro in the Philippines (see case study), farmers have begun to use organic fertilisers. The local government launched an Integrated Pest Management (IPM) programme aimed at training and educating farmers. Thus far, however, only 27% of the participants have decreased the level of pesticide application.

2.2.vi Biodiversity

Urban agriculture can have a positive effect on increasing biodiversity. The urban environment is often already richer in flora and fauna than rural farmland; beehives in cities in some developed countries like the United Kingdom or Germany actually produce more honey than those in the countryside. This is because cities are often home to more trees and flowers than intensively-farmed agricultural land with large fields, limited crop diversity and little uncultivated area. In Cagayan de Oro (Philippines), a “Greening” project that constitutes part of the City Agricultural Office’s (CAO) urban agriculture programme aims to increase the production of fruit and forest tree seedlings, specifically to improve the biodiversity in the city.

2.2.vii Global warming and atmospheric pollution

Urban agriculture can help contribute to reducing the net discharge of CO_2, one of the gases contributing to global warming, from activities in cities. If more cities were to produce food within their boundaries, bringing places of production and markets closer to each other, the transport of products can be reduced; this would contribute to reducing emissions of CO_2 and other polluting gases. Urban agriculture is also a means for reducing the net discharge of CO_2, because plants and trees capture CO_2. The captive capacity is at its highest in the growth phase of vegetation. Through agricultural activities in cities, urban ecosystems are kept continuously in their “primary production phase”; which means that much more CO_2 per surface area is captured than in natural systems like tropical forests. In cities, however, much of the carbon stored in vegetation is likely to be quickly released through decomposition of organic matter and there may be little lasting benefit.

2.2.viii Environmental awareness

Urban agriculture can also change the perception of people in cities regarding food. The direct experience of growing food is largely absent in urban life in the "developed" countries; people harvest at the supermarket and most people have come to expect food to be packaged and even pre-cooked. As city people, they are hardly aware of the impacts of food consumption on the fertility of farmland supplying them, often from distant places. Too many people eat unhealthy "junk" food.

The recognition of urban agriculture among citizens is related to the size of production activities in this sector within the city (Barrs 1997). People will often have more interest in the food-growing process and the biophysical processes involved when crops are locally cultivated. Their knowledge can be expanded through agricultural and environmental training and education. This could increase the influence citizens have over the way food is produced. People will understand what sort of inputs are used in the farming process and they can quickly respond to any harmful environmental practices. Urban agriculture can re-educate us about the ecological base of food, and the links of food production to natural food chains, as well.

Skills associated with urban food growing and related enterprises are not necessarily simple or primitive. Organic growing techniques, for example, can make use of the results of innovative scientific research. If any of the produce is sold – processed or not – then the people involved will develop a whole range of sales and marketing skills of varying degrees of sophistication. And food growing is adaptable to nearly everybody's circumstances; from a window box to several acres, from conventional gardening to full-scale organic, from a few herbs and a tomato plant to bees, chickens and goats.

A good example of growing environmental awareness among citizens can be found in London, where local councils promote urban food growing through Local Agenda 21 strategies in almost all boroughs. There are various community projects aiming to improve the environmental performance of urban agriculture (see Box 1).

BOX 1: Becontree Organic Growers, London

This is a co-partnership of local people formed to revitalise an overgrown site in East London (see case study). The site is located next to allotments, many of which have fallen into disuse. Permaculture techniques will be used and the group hopes to keep much of the wildlife which has established itself on the derelict site by not removing all the nettles and weeds. It also hopes to boost honey production by doubling the three hives they already have. They will re-use and recycle resources, save energy by recycling water and using solar heating, monitor the local environment, conserve nature, use “green” buildings, work with students and local schoolchildren, and develop the local economy, particularly by using Local Employment Trading System (LETS) schemes. LETS is a scheme whereby people exchange goods or services instead of using money.

2.3 Prospects for urban farming: policies and approaches for the 21st Century

Urban farming is clearly alive and well in many countries. New marketing initiatives and approaches to promote participation in urban environmental management auger well for the future of the sector.

2.3.i Marketing initiatives

New ways of marketing urban produce are helping to advance the case for urban and urban-fringe agriculture. Clever marketing, as well as the desire of consumers to know where their food comes from, has a lot to do with the surprising growth of farmers’ markets in the USA. Some 2000 new farmers’ markets have been set up in US cities in recent years, often run by the growers themselves on the urban fringes of cities such as New York, Chicago, Detroit, Washington and San Francisco.

Nobody would suggest that all city people will want to grow food themselves. But urban agriculture also has the potential for bringing growers and consumers closer together. Vegetable box schemes, providing customers with a selection of vegetables in-season from locals farms, enjoy growing popularity.

Another scheme to bring together growers and local customers in a mutually beneficial arrangement is *community-supported agriculture.* This is becoming popular in both Europe and the USA: in such schemes, participants purchase a share in any produce in advance. Participants acquire the right to visit a farm and to help in the cultivation and harvesting of crops, if they wish. An additional benefit is that participants may also get a say in what crops are grown. Such schemes have proved that crops produced for local consumption can be very lucrative and that mutual arrangements between growers and consumers can also be environmentally and culturally beneficial.

2.4 Promoting integration and participation: challenges to urban planners and policy- makers

Urban agriculture can reduce the "ecological footprint" of cities when environmental goals are combined into an overall urban policy (Van Delft & McDonald 1998). Such overall urban policies would include environmental awareness-raising and wide public participation in urban development. In this section, examples are given of such integrated policies which provide examples of good practice and challenges to planners and policy-makers around the world.

Local authorities and specialists in Vancouver (Canada) have promoted progressive programmes on urban agriculture utilising wastewater/sewage streams from buildings (Barrs 1997). The wastewater stream from residential buildings represents a potential resource (water and nutrients) that can be used for urban food production. The "Solar Aquatic" sewage-treatment system introduced in Vancouver duplicates the natural purifying processes of meadows and wetlands, utilising bacteria, algae, plants and aquatic animals to produce treated wastewater ready for use to irrigate crops. The process is accelerated using controlled greenhouse conditions, reducing the amount of costly urban space required. Another approach adopted in Vancouver is to reduce the production of organic waste at source. This will be achieved by providing consistent composting messages across the region, and providing training in composting techniques, educational resources and support to member municipalities for the delivery of education and promotion programmes. The aim is to create greater awareness in Vancouver about the potential of organic waste for city farming.

The town of Kolding, Denmark, provides another example. A group of apartment buildings used to surround a piece of wasteland, which was occupied by old cars and other pieces of waste. The area was considered to be unpleasant and unsafe. To regenerate the buildings and the surrounding space, a clever system has been developed. Nowadays, the wastewater from the buildings is being collected, together with the rainwater, and filtered through a cascade system. The system culminates in a glass pyramid that has been built in the middle of the neighbourhood. At the bottom of the pyramid, the final nutrients from the wastewater are used to breed fish. Other parts of the pyramid serve as greenhouse areas for plants and vegetables. Some people have now found a green job in the pyramid, and are working in the greenhouse. The area has become a very nice place for the inhabitants to meet and relax and also for children to play, especially because of the visual and acoustic effects of the flowing water.

Other examples of urban agriculture find their origin in community spirit and existing strong social cohesion. This co-operative spirit can be found in many developing countries. An example is city farming in Albania (Chisholm 1996). The end of communist rule was accompanied by the destruction of many irrigation systems, greenhouses and other infrastructure. On account of poor living conditions, people were forced to take their own initiatives in adapting their survival strategies. Agriculture for self-consumption and trade are fundamental sources for food security. Many people live in apartment buildings and have no access to land, so they grow tomatoes in old bowls on their balconies. Several people have even managed to create a flourishing garden on rooftop spaces. Onions, garlic, tomatoes and grapes have transformed ugly buildings into nicer places. People made use of their local environment, fully exploiting their own limited devices. There are even persons who raise pigs in their houses. Despite bad odours and noise, neighbours don’t complain because they understand that people need to survive. Almost every small space of land is used productively. Urban agriculture in a developing country like Albania shows that, despite the limited resources available, opportunities exist to make human settlements sustainable. This is a lesson to be learned in industrial countries.

2.5 Implications for urban policies and programmes

Traditionally, agricultural policies – whether oriented towards export production or local food production – have focused on maximising short-term profits rather than on long-term environmental management of local resources. Many urban managers and planners think of their city more in terms of housing, transport, commercial services and industry, rather than in terms of agriculture, which generates relatively low yields (Girardet 1992).

Generally, urban agriculture suffers from a combination of political restraints, that include (Van den Berg & De Zeeuw 1998):
restrictive urban policy, laws and regulations (due to the mainly illegal status of urban agriculture);
uncertainty about property rights of land;
lack of supportive services;
unfeasible implementation of environmental technologies; and
lack of organisation and representation of urban farmers.

As a principal issue, it is proposed that urban farmers and consumers should receive more information and training on environmental risks (e.g. wastewater treatment and composting techniques) because more urban people will be engaged in growing food and more cities are beginning to try to use their agricultural waste to curb pollution and optimise freshwater usage (Reijntjes et al. 1992).

There is a need to stimulate dissemination of good practices in urban agriculture to farmers and consumers. In this respect, Barrs (1997) envisions an important role of policy-makers. They are, or should be, able to support farmers and consumers to build up knowledge about the opportunities of urban agriculture to protect city ecology. The key issue is how opportunities of urban agriculture can be translated into sustainable initiatives. National governments need to reduce the environmental risks of (urban) agriculture by adopting pesticide reduction targets, and promoting biological pesticides and fertilisers. Finally, governments must also provide funds for information and grant-aid schemes to assist conversion to less chemically-intensive systems. At first sight, small-scale farmers in developing countries need appropriate strategies and production techniques that lead to higher yields. However, many farmers recognise that they cannot continue to increase yields, because more resource-intensive production methods inevitably lead to the depletion of available natural resources.

To support farmers in making their production systems more productive and sustainable, development workers – in their turn – need suitable instruments for co-operation with these farmers. The question is how development workers can support farmers in urban agriculture to protect or improve city ecology. Reinforcing farmers' capacity to develop and manage technology is of vital importance for the actual creation of environmentally-friendly ways of farming. There may be many steps required to reach that objective.

A fundamental step in order to set the right conditions for city farming is to develop an urban agriculture plan and policy, recognising the interrelated nature of food, agriculture, health and ecology by forming a municipal working group that can deal with food issues from a total system perspective. This could involve, among others: the health department, planning department, engineering, local economic development, water management and waste management. Following this, the urban agriculture plan should be incorporated into the land-use planning system. This implies that urban agricultural activities are recognised as major components of green zoning systems, for which a dedicated policy must be formulated, developed and implemented.

It is hard to regulate good practice, but labelling food to show how and where it is produced at least allows people to make informed food choices and to support sustainable approaches to production. Programmes such as the provincial "BUY BC" campaign in British Columbia, Canada, encourage people to purchase locally-grown food and other products. In British Columbia, there are strict guidelines for production, operation and farm management. Only those farms certified by an approved certification agency (in this region, British Columbia Association of Regenerative Agriculture, BCARA) are allowed to market and label their products as "organic" and attach the "BC Certified Organic" label.
As urban agriculture becomes more sophisticated, lending institutions will become aware of the financial possibilities involved. However, this is not yet generally recognised. Difficulties in obtaining sufficient capital and credit to start an urban food-production business hamper all sorts of initiatives. However, government bodies can offer favourable conditions to city farmers in less developed countries regarding urban agriculture, through for instance the following policy interventions (Barrs 1997):
start-up grants/loans for small urban agricultural businesses;
subsidisation of inputs such as municipal compost for a limited time to stimulate projects.

If the potential of urban agriculture is going to be realised, much more has to be done than what is happening in many cities at present. What is needed is a policy for the city that focuses on encouraging the productivity of open urban space, integrating the various components necessary to make urban agriculture healthy and sustainable, and combating bad practices where necessary. Urban agriculture can have a positive effect on the availability of healthy, nutritionally balanced and culturally appropriate food, in particular for low-income groups of the urban population. Since food is a basic requirement for a healthy life, this should be seen as an absolute priority in urban policies. Local food production may never replace the need of a decent level of income, but it can substantially contribute to adequate and culturally appropriate sources of human nutrition.

3. Conclusion

All in all, prospects for urban farming are good in many parts of the world. However, it is crucial that planners start recognising the importance of urban farming in the rich mix of activities that characterise modern cities. As the world urbanises, greater local food self-reliance, using nutrients accumulating in our cities, must be regarded as an important aspect of sustainable urban development. Together with initiatives on energy efficiency, high resource productivity and policies for containing sprawl, urban agriculture has an important contribution to make towards shaping the cities of the future.

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THE IMPACT OF URBAN AGRICULTURE ON THE HOUSEHOLD AND LOCAL ECONOMIES

Rachel Nugent

1. Urban growth and livability

As cities grow, they add jobs and services, becoming more complex economically as well as physically. The need for new jobs places huge demands on cities that are struggling to provide the public services that growth demands, often in the face of existing unemployment. In the developing world, many of the new jobs needed are for unskilled and relatively uneducated workers, both migrants and those born in the city.

With labour forces growing by 2-3% per year in the fastest urbanising countries (East and West Africa, Southeast Asia, East Asia), thousands of new jobs must be created each year in each of the major cities in those regions. For example, in order to keep the unemployment rate from rising, more than 250,000 new jobs are needed each year in Jakarta, more than 77,000 jobs in Ouagadougou, and more than 44,000 in Dar es Salaam. Partly as a result of the job market lagging behind urban growth, urban poverty and the share of the poor living in cities are rising (IFPRI 1999). These trends have serious implications for food security.

This paper explores economic conditions and policies in urban areas that create the impetus for urban agriculture to exist, and which affect its viability. In doing so, it focuses on the conventional scope of economic impacts – such as employment, income and value of production – and leaves in-depth discussion of cultural and environmental impacts to other contributions. This paper relies on a series of case studies as well as first-hand knowledge and information from other sources. The effort is made to draw conclusions about the economic relevance of urban agriculture based on both quantitative and qualitative knowledge.

1.1 Labour markets in growing cities

The prolonged structural unemployment that exists in many cities is of serious concern. It is caused by a mismatch between labour force skills and needs of local employers, an inflow of workers that is consistently higher than the ability of an area to absorb them, generally low job availability in weak economies, or a combination of the above.

Official unemployment statistics may understate the severity of unemployment because they are not gathered frequently and quickly become out of date in fast-growing cities. Another reason is that many people find work in the informal sector, where they may move easily and often from one job opportunity to the next. What appears to be employment is often disguised underemployment, especially when economic conditions are weak. An estimated 56% of urban employment throughout Africa is based in the informal sector, as is 40% in the Asia/Pacific region and 30% in Latin America (UNCHS 1999).

A few examples will illustrate the dramatic conditions existing in labour markets around the world, and the effect of sudden shocks on already shaky economic foundations. The official tally of unemployment in Jakarta is estimated to have risen from 4.9% to 21% following the 1997 Asian financial crisis (IMF 1999). One in every five formal-sector jobs disappeared and 37% of formal-sector workers in Indonesia became underemployed. This means that they became obliged to work informally to augment their formal sector wages. A large share of the informally employed workers – estimated before the crisis as 33% of the labour force – were likely forced into unemployment or to the countryside.

In Nairobi, enduring economic recession and structural adjustment severely restricted employment opportunities during the 1990s, even as the population grew by 51%. Between 1994 and 1997, informal unemployment increased by 65% to two-thirds of the workforce (Foeken & Mwangi 2000).

The population of urban poor and informally employed is growing absolutely and relatively in cities across the world. Universally, they are seeking a livable city, one that provides ways of earning money and meeting basic needs, whether within or outside the formal labour market. One of the activities they turn to is agriculture.

1.2 Agriculture in urban areas

As officially measured, agriculture does not make a substantial contribution to urban employment and GDP. Countries lose primary sector jobs, such as agriculture, forestry and fisheries, as they become more urban. In their place, they create industrial and service jobs. The same is true within cities themselves and the areas surrounding them. What were once villages become towns, and towns become cities. Land faces greater demands and fetches higher prices as buildings and infrastructure multiply and density increases. Multiple uses of land emerge, people desire proximity to jobs and services, and land "improvement" spreads. As this process evolves, cities change and the agriculture practised within and around them changes.

Urban agriculture takes various forms at different levels of development. With a given set of topographical features, climate and traditions, urban agriculture changes in response to income growth and urban development. Certain conditions are necessary for urban agriculture to exist, but not sufficient to bring it about.

For instance, Mexico City saw its officially recorded agricultural labour force decline from 9% of the total in 1980 to less than 1% in 1990 (Duque et al. 1999), at the same time, the city's overall labour force fell slightly. The conditions leading to this decline are not atypical of growing cities in Latin America: land speculation and expansion of commercial buildings, mechanisation and concentration of agricultural activity, and concentration of food marketing in large supermarkets. What remains is an active, commercial periurban agriculture that provides a substantial number of jobs, but relatively little contribution to food security for the poor (*ibid.*).

Conversely, because it progressed less, urbanisation in Africa so far represents a different phenomenon with differing implications for urban agriculture. On account of lower population densities and traditional social behaviours that persist even after migration, urbanising areas in Africa are generally hospitable to household food production.[1] They still contain large amounts of arable open space, people are more likely to raise small livestock for home consumption, and municipal policies may be more congenial to food production (though exceptions will be noted further in this paper). The effect on measured agricultural employment appears minor, while the effect on food security is significant.

Asia's aggregate urbanisation level is relatively low because of populous countries (China, India, Pakistan) that are largely rural. In fact, by 2025, Asia will be home to 12 of the15 largest cities in the world (FAO 1998). This demographic diversity implies that urban agriculture exists in different forms in the region: those with dense, crowded and relatively industrialised populations; and those with open spaces, greenbelts, strong agricultural tradition, and much cultivation and small livestock rearing. Examples of each are readily seen in the case studies prepared for this Reader.

1 Population density in Dakar is 3,527 inhabitants/km^2, in Harare 1,695 inhabitants/km^2 and in Mexico City 5,700 inhabitants/km^2.

Another type of urban agriculture predominates in North American and European cities, though scattered examples can be found in cities around the world. It is conducted in backyards, community or allotment gardens, is relatively intensive and productive, and usually for home consumption. These northern farmers seek recreational benefits, organic or otherwise healthy foods, and social interaction. Poor farmers are also found in the cities of developed countries and, like their counterparts in the rest of the world, they farm to enhance their food security. Likewise, commercial farming in periurban areas is a major economic contributor in developed country cities. These farmers exist in smaller numbers and different circumstances than those in developing countries, whose agriculturists are the focus of this paper.

The aforementioned regional patterns are suggestive only and are not meant to imply that all cities in those regions fit the patterns. Climate is a critical factor determining the role that local production can play in the urban food market. In the humid tropics and temperate zones with adequate water, planting can be done through multiple growing cycles and harvests provide year-round fresh crops. In arid and semiarid climatic zones, the production is more likely to be seasonal.

Urban dwellers everywhere face a combination of density, climate, resource availability, cultural and policy conditions that will make a city more or less hospitable to farming activity, in addition to the household-level decisions that will be discussed below. Together they determine the level of effort that will be devoted to urban agriculture in a given locale.

1.3 Sufficient conditions that create urban agriculture

Depending on local conditions (primarily economic, but also social, cultural and political), the opportunity to grow or acquire locally-produced food is a critical component of the ability to live in the urban environment. Some of the food enters formal marketing channels, while some is bartered, given away and consumed by the growers.

The poor are not the only people who produce food locally, but they are more dependent on it for income and nutrition. While it is not hard to imagine rural dwellers feeding themselves largely from their own agricultural production, it is rare that urban people – either rich or poor – can or even wish to obtain a large proportion of their caloric and micronutrient intake from their own gardens. It is reasonable to ask, therefore, under what combination of circumstances urban agriculture is most likely to emerge and to make an important contribution to

urban welfare. These circumstances can arise suddenly or develop over time; they can be temporary or permanent.
The conditions in which food production suddenly becomes important in a city are emergencies from civil, weather or macroeconomic upheaval, often combined with a high incidence of poverty, inaccessibility to adequate food supplies from rural areas or imports, and good growing conditions.

Civil upheaval and conflict spurs urban dwellers to plant fast-growing crops on unused land to replace the normal food supplies disrupted by war (e.g. Kosovo). Likewise, a very unstable macroeconomic climate characterised by spiralling prices, shortages and other market fluctuations has frequently engendered the spontaneous creation of community and backyard gardens (e.g. Ecuador, Indonesia).

The transformation of the Russian economy from the early 1990s led to greater quantities of food produced for self-sufficiency in both urban and rural areas (Seeth et al.1998). Home production in 1994 (both urban and rural) had risen to 38% of agricultural output from 24% in 1990. Similarly, Sofia went through food crises in 1990-91 and 1996-97, and urban agriculture contributed substantially to food availability and stability.

In Accra, a programme of “Operation Feed Yourself” was instituted during a food shortage period of the mid-1970s. Residents grew food in backyards and open spaces. Eventually the programme declined as land was developed and the food supplies improved. A very similar situation existed in Dar es Salaam during the early 1970s, as government encouraged residents to grow food and made space available. After a pause in local cultivation in the late 1970s, food production is once again common.

In addition to temporary and emergency events, urban populations farm or garden because of long-standing traditions of urban food production (e.g. Cairo, Nairobi) or because political and economic factors create the incentives to do so on a regular basis (e.g. Havana, London). For instance, cultural factors among Muslims in Cairo make it imperative to raise small livestock for ritual food preparation surrounding holidays and funerals (see Cairo case study). In Havana, the loss of economic support following the break-up of the Soviet Union led policy-makers to devise incentives for community production (see Havana case study). In London, residents who seek a greater community involvement, greening and fresh healthy food, become involved in community gardening (see London case study).

Increasing urban poverty is a contributing factor that appears not to be temporary (IFPRI 1998). Most of the food consumed in cities must be purchased. Poor families can spend 60-80% of their income on food and still be food insecure. Consumer food prices in many cities of the developing world have spiked upward since the removal of subsidies and price controls accompanying structural adjustment policies in the 1980s and 1990s. For instance, food prices in Harare rose 534% between 1991 and 1992, spurring poor urban consumers to get access to food outside of marketing channels through home production and barter (Tevera 1996). Even after a more stable macroeconomic environment was restored, urban gardening has remained an important source of food for the large urban food-insecure population. In La Paz, where poverty has reached 73% in slum areas, subsistence production is cited as a way to reduce household expenditures on food, which averages 52-83% of income.

2. Urban agriculture at the household level

Households face choices in how to allocate their labour and their expenditures in order to maximise their welfare within a constraint of limited resources. A simple economic model predicts behaviour that would bring the most income into the family. This means family members jointly choose how to allocate their work time to the most remunerative income-generating activities over a given time horizon.

However, urban farmers are simultaneously suppliers of labour to agriculture, and producers and consumers of food. This makes the maximisation problem more complex. In order to understand household behaviour with respect to urban agriculture, the existence of other factors that affect income expectations must be brought into the analysis.

The major economic complications are imperfect labour and land markets in urban areas, unreliable or sporadic market information available to some urban dwellers, and poor quality or non-existent markets for inputs, such as credit and fertiliser. Such conditions imply that a household is likely to have a complicated definition of welfare that could include diversification of income sources, adaptation to underemployment, and other goals that will help assure its well-being under conditions of uncertainty. Additionally, other factors, such as social expectations, risk perceptions, cultural mores and family gender relationships also come into play and may be even more important than economic factors.

This section outlines the behavioural process of urban households facing the decision of whether to farm. On a microeconomic scale, the decision to engage in urban agriculture will lead to changes in how a household allocates its time and expenditures. Therefore, from the perspective of suppliers of labour, households will produce food themselves if the farming activity provides a higher return (either monetary or in-kind) for the effort expended than other activities. Added to that decision process is the perspective of households as food consumers. A household will produce its own food when it is less costly (in terms of time and money) than purchasing food.

The effort put into urban agriculture can be derived from the household's constrained welfare maximisation problem:

Goal: Maximise household welfare from among employment alternatives, including leisure.

Given: Household resources, such as labour, capital and set of skills;
Prices of and access to foodstuffs and other consumables;
Prices of and access to needed inputs, including land;
Risks and uncertainty about markets, policies, and weather.

2.1 Why do households engage in urban agriculture?

As commonly happens, the simple economic model set out above faces a reality much more complicated than implied by theory. Interviews with urban farmers (from the case studies) reveal that the kinds of behavioural and economic incentives facing the household vary, even within the same city and culture. The decision to farm and the level of effort spent on urban agriculture do not have a clear-cut relationship to income, wages, prices or employment opportunities. Despite these complications, the model provides some insights into household behaviour, and suggests which other factors and incentives should be investigated (and perhaps modelled) in order to better understand household decisions.

2.1.i Factors affecting household decision to farm

Seventeen city case studies have been reviewed as background for this analysis (Accra, Cairo, Cayagan de Oro, Dakar, Dar es Salaam, Harare, London, Mexico City, Sofia, Jakarta, Lima, Havana, Shanghai, La Paz, Ho Chi Minh City, Hubli-Dharwad and Nairobi), along with surveys and data from other research. The city case studies are extremely variable in their sampling methods, scope and presentation of data. Nonetheless, some conclusions can be drawn at this stage regarding household economic behaviour and urban agriculture. As the research in the field is refined and elaborated, the conclusions presented here will also be reviewed and corroborated or recast.[2]

Ranked in order of importance (numbers indicating occurrences), survey respondents give the following reasons for engaging in urban agriculture:

1. Production for home consumption (13)
2. Income enhancement (8)
3. Economic crisis (6)
4. High prices of market food (5)
5. Income or asset diversification (4)
6. Supplementary employment (3)
7. Conflict (1)
8. Poor weather (1)

Note that the top six motivating factors for these urban farmers are economic. Further, the reasons given are not mutually exclusive, as farmers were allowed to list multiple reasons. It is evident that some of the reasons listed above could have identical interpretations.

Food insecurity or the perceived risk of food insecurity is a common concern among almost all urban farmers. Households across the income spectrum engage in urban gardening (with some country exceptions and commodity variation), but income level does influence the amount of effort devoted to urban farming. Even in non-poor populations, a household's perception of food insecurity risk will affect its farming effort because of the insurance value of own food production (Seeth et al. 1998).

For example, many urban households in Hubli-Dharwad keep buffalo as a sort of savings account to be sold in times of extreme hardship. At the same time, the buffalo provide milk and fuel in the form of dung. Likewise, in Accra, small livestock are maintained as assets in case of emergency. This is very common within the city and families often prepare to sell livestock to pay for educational fees or funeral costs. The average value of assets held in Accra households is $50.

2 Note that, with the exception of London, all the commissioned city case studies are from developing or transition countries. Thus, the discussion in the paper focuses on households in developing countries. The results would be very different if the focus were on developed country household behaviour.

Other reasons for urban farming not mentioned in the surveys are ethnic traditions of recent migrants (La Paz) or lack of employment opportunities (Nairobi).

Among the clear patterns that emerge from the survey data is that urban farmers say they wish to enhance household food supplies, rather than increase cash income or obtain employment. In addition to the high frequency with which respondents cited the need to produce for home consumption (13), the surveys imply a similar impulse is behind the motivation of an economic crisis (6) and high prices of market food (5). If this interpretation is correct, then production for home use is almost three times as important as income enhancement, as a motivating factor for urban farmers.

However, this distinction should not be taken too far. From an economic perspective, farming yields direct income through sales and employment, or indirect income through reduction of expenditures on food. Whether the income is money or “in-kind”, it has value to the urban farmer. Indeed, food produced in urban areas has value even if it is fed to animals, given to needy populations in the community, or traded for other products.

A comprehensive view of the incentives to farm include both the in-kind income flow, as well as actual income earned from any sales or employment in urban farming. Income from urban farming is discussed in the next section. Wage-labour aspects of urban agriculture are discussed in the section on aggregate economic impacts.

2.1.ii Income from urban farming

Some survey data are available about the level of income earned from urban farming. However, it is risky to generalise because the farming conditions vary enormously from season to season and city to city. Examples are given here primarily as illustrations of the variability of earnings from urban farming.

In African countries, it is generally the poor who are cultivating in urban areas, but the Harare survey of 720 households shows that higher-income farmers engage in more gardening and cropping activity, such as maize growing (ENDA 1999). The highest income earned was the equivalent of 7 months’ salary at the industry minimum wage, while the average earnings were equivalent to about two weeks of an industrial salary (US$7) (ENDA 1996). Other research from Harare puts income earnings at 10% of total for the 40% of high-density-area producers that sell their output.

In several African cities, income earned by urban farmers was found to be a significant contributor to household maintenance. Home gardens in Lusaka produced an average of three months' income at the average worker level in 1992 (15,000 Zambian Kwachas in 1992), but was extremely seasonal (Drescher 1999). An earlier study found that low-income households in Lusaka obtained one-third of their total food consumption from farming (Sanyal 1986, cited in Tevera 1986). Farmers in Accra earned very little cash, but produced 1-8 months' supply of staple food for their families, and used their farm output as a consumption-smoothing and income-diversification strategy. Especially for vegetable growers, income from farming could represent significant amounts and proportions of total income.

Estimates from Dar es Salaam indicate that full-time production of certain vegetables or keeping a few dairy cattle and a garden can produce an income of $US 60/month – 30% greater than the average salary. The same is true for Nairobi families in slum areas, although they sold relatively little and consumed their own output. These families' standard of living exceeded that of neighbouring non-farming families.

In Sofia, a large proportion (28%) of households earned something from urban gardening. Official statistics show 1-2.6% of total income comes from this source, but this likely excludes a large number of the informally employed in agriculture.

A comprehensive household survey in Russia revealed that urban gardeners in three capital cities earned an average of 12% of their income from gardening in 1995, while in smaller cities the proportion of income earned was 10.6% (Seeth et al. 1998). Based on average monthly incomes, the earnings from gardening in Russia are much higher in rural than in urban areas, but the poverty level is higher in the latter.

2.1.iii The calculation of income from urban farming

The economic consideration facing a potential urban farmer includes a variety of external factors, along with the non-economic factors mentioned above. Once a decision is made to put effort into farming – based on the factors listed above – the next decision is to choose the appropriate level of effort to invest in farming. The net income flow depends on:

- farming effort;
- availability and cost of basic inputs;
- yields, as determined by technology;
- access to market or other buyers;

- ability to store, transport, process and preserve products;
- prices, as determined by supplies and demand of related products.

Farming effort
Because agriculture is rarely the sole or even primary source of household earnings, effort devoted to it fluctuates in response to potential earnings from other endeavours. In this sense, urban agricultural income is a residual; its level is determined by forces in external markets or other events. For instance, agricultural work is used as a buffer for low-income families who face periods of unemployment from other seasonal employment, such as in construction. Further, during periods of high expenses – such as just before school opens or holidays – families might reduce expenditure on agricultural activity (for seeds, implements, etc.), and thereby reduce expected income earned from the plot, or they might increase effort in farming in order to sell the surplus product.

In Russia, the average level of effort applied to urban gardening is about four days per month. The effort declines significantly with an increase in wages or travel time to the farm (greater opportunity cost of farming), and this effect is stronger among the high- and middle-income gardeners than among the poor. The survey responses demonstrate that the poor are less likely to reduce their farming effort in response to these other factors, as food production provides them with insurance against food insecurity (Seeth et al. 1998). This shows that the better-off gardeners have more choices of alternative activities, and less urgent need of the food produced in their gardens, while the poor in Russia (despite high transportation costs to reach their plots) have low elasticity of labour supply.

Availability and cost of basic inputs
The ability to obtain needed inputs also affects the level and timing of income from farming. Access to land is the factor that urban farmers identify as most critical to their success, in terms of both the decision to enter urban farming and the level and variability of income. In densely-populated cities, lack of land clearly inhibits farming activity (e.g. see case studies from Cairo, Lusaka, London), while the ready availability of public spaces or unused land in other cities (e.g. Dar es Salaam, Harare until recently, Dakar) make urban agriculture attractive even if public policies do not encourage it. In some cities, the farmers are those who have their own land area – however small – that provides security. This is true in La Paz, where many surveyed residents say lack of owned land prevents them from farming. Conversely, in Nairobi, though farmers rarely own their own land, they also did not indicate major concern about eviction.

Households that can obtain credit are less likely to sacrifice their agricultural needs for other expenditures, and instead will develop a sophisticated cash-flow behaviour in which they invest during planting season with borrowed funds, and repay from sales after harvest. They may even accumulate savings from agricultural surpluses. Frequently, livestock are used as a form of savings when credit is unavailable. This behaviour mirrors that of well-off rural farmers and illustrates the importance of risk-management techniques for enabling rational economic behaviour. This is another area in which appropriate policy development can change the landscape of urban agriculture.
Access to and costs of other inputs, such as seeds, implements and chemicals, is not frequently mentioned as a critical issue – though pest control and lack of water are known to be serious problems in many cities. This lack of attention in the surveys may simply reflect the seriousness of the other obstacles mentioned – serious enough to keep many from engaging in urban farming – or the acceptance of these barriers as a normal part of farming practice. Further, it probably again reflects that urban agriculture is a residual activity within imperfect markets. As such, it is conducted opportunistically and with relatively little investment.

Yields
A third determinant of the income flow from urban agriculture is the yield obtained from a given amount of inputs. The yield will depend on the quality of the factors used in farming, climate and the level of technology available. One common assumption about urban agriculture is that yields are quite low – largely because of poor-quality inputs, low-technology farm practices and high losses from a variety of sources.

Such conditions are common in urban agriculture and could help explain the observed household behaviour of not maximising income. However, such conditions are not universal. High yields have been documented by urban farmers in some cases (see cases cited in Nugent 1999a and FAO 1998b, Smit et al. 1996), and clearly are potentially available to many urban farmers. Addressing yields through availability of good quality inputs and technical advice is a key area of policy intervention.

Market access
The ease of access to a market is a factor in assessing the net income provided from urban agriculture. If the urban farmer ends up with a surplus of food that cannot be consumed or sold, the income is lost, though the food will have some social value if it can be given away. Such social value will generally not enter into the urban farmer’s calculations to expend private effort or resources on

urban farming. Sometimes, it is lack of easy access to a market that encourages urban food production to develop. In such cases, an informal market will often develop spontaneously and the farmers' perceptions of being able to sell surplus product will determine in part the effort devoted to farming. Thus, a heterogeneous neighbourhood, in which not all residents are producing food, and the presence of some purchasing power are factors which encourage farming in the absence of formal markets.

Ability to store, transport, process and preserve
The urban farmer with knowledge, space and equipment to store and/or process her output is likely to increase her income potential. A strong presence of street foods in a city is likely to create links between producers and vendors, sometimes within the same family. The risk of income loss from spoilage, theft or damage to crops and livestock can be reduced with storage and preserving facilities. These factors enter into the risk evaluation done by a potential urban farmer, especially when the available land is not secure or is far from the residence.

Prices
A final factor determining income flow for urban farmers is the prices of related products. In general, when prices of garden foods in the markets are low, urban dwellers will have one less reason to produce their own food, and when prices are high, that should increase incentive to produce. This factor is strongly related to income levels, the poor being more vulnerable to the effects of price fluctuations in the markets.

2.2 Gender aspects of urban agriculture

The household labour (who and how much) devoted to urban agriculture is determined by non-economic factors more than by what can be earned in other activities. One reason may be an absent or incomplete labour market, especially for women, in cities in developing countries.

Research in India shows that women make up a disproportionate share of unpaid helpers in household enterprises, and are concentrated more than men in the agricultural sector. Wages for women in agriculture averaged roughly to 20% of men's wages (Duchin & Sinha 1999). A survey made in Turkey revealed that women who worked in traditional sectors and non-market activities received significantly lower incomes than men in the same circumstances (Esim 1999).

In general, Africa has the largest proportion of women involved in urban agriculture, except in Dakar and Accra, where men make up the majority of urban farmers. Explaining the latter, Armar-Klemesu and Maxwell (1999) point to traditional cultural behaviour, intra-household income behaviour, and other female responsibilities. In Harare and other cities where urban agriculture has less official support as a sector, women provide most of the work. This derives from their responsibility for household food provision and preparation. The same pattern is evident in Dar es Salaam, where the more commercial ventures are dominated by men and the subsistence farms belong to women.

However, in many of the cities studied, the majority of market vendors are women. Proximity to the home and neighbourhood make this a more logical enterprise for women. Conversely, in Cairo, women are primarily responsible for the rearing of small livestock, but are prevented by *purdah* or other social prohibitions from marketing the product. In Cagayan de Oro City, men do most of the farming, while women attend to all other household tasks (Potutan et al. 2000).

If the primary gardener is a man, often his wife serves as back-up labour, whereas this is not always true in the reverse. The evidence is that children's labour is used in urban farming, especially when a woman is head of the household. In Dakar, women and children work for the family plot which is controlled in about 75% of the cases by a male adult in the family. This is especially true when there are significant start-up costs, as in poultry raising and floriculture. Women are more represented among vegetable gardeners.

2.3 Conclusions about urban agriculture in the household economy

It would appear from the case studies, as well as from other research, that urban farmers engage in a mixed strategy of risk minimisation and food supplementation. Various motivations for farming in the city demand varying levels of effort; sometimes a minor part-time effort can result in adequate amounts of food to satisfy a family's needs for e.g. green leafy vegetables, plantain, fruit and/or eggs. Rarely is produce from one's own garden the sole source of food for an urban family. Urban farmers respond to opportunities, such as available land, income enhancement potential and a supportive local environment.

3. Urban agriculture and regional impacts

3.1 Measuring the aggregate impacts of urban agriculture

Moving from the household level to the aggregate economy, one tries to measure urban agriculture's contribution to a city's overall economy by calculating the value of the output created by this sub-sector. This is determined by the quantity and market value or price of the goods. However, because much of the output from urban farming is not sold in markets and prices cannot be easily determined, official statistics usually do not capture most of this activity. A few studies have estimates of total value, while others indicate volume of production, or share of urban food needs produced by urban agriculture.

Table 1: ***Food provided by urban and periurban agriculture***

City and year of estimation	Local needs met by UPA (in %)	Amount produced annually (in tons, unless noted)
Havana, 1998		541,000 (vegetables)
Dakar,1994/95	70 (vegetables) 65-70 (poultry)	43,000 (vegetables)
Harare, 1999	small	
Dar es Salaam, 1999	60 (milk) 90 (vegetables)	
Jakarta, 1999	10 (vegetables) 16 (fruit) 2 (rice)	
La Paz, 1999	30 (vegetables)	
Hubli-Dharwad, 1999	small	40,000 litres/day
London, 1999		8,400 (vegetables)
Ho Chi Minh City, 1999	high	217,000 (rice) 214,000 (vegetables) 8,700 (poultry) 241,000 (sugar) 27,900 (milk) 4,500 (beef)
Sofia, 1999	48 (milk) 53 (potatoes) 50 (vegetables)	
Accra, 1999	1 (total)	
Shanghai, 1999	60 (vegetables) 100 (milk) 90 (eggs) 50 (pork, poultry)	

(Sources: case studies prepared for this Reader)

The existing estimates of economic output provided by urban agriculture give a range of values for different cities (annual contribution for the years cited):

- Lima (case study 1999) 4% city GDP in 1995
- Shanghai (case study 1999) 2% of city GDP
- Dar es Salaam (Howarth 1996) $25 million
- Hartford, USA (Nugent 1999a) $ 4-10 million, depending on area included
- Harare (ENDA 1996) $ 5 million, maize production only
- Nairobi (Mazingira 1985) $ 4 million

Because these studies used different methods and different years and apply to different commodities, no attempt is made here to make the results comparable. These results highlight the necessity to develop a standard research methodology for assessing the economic impact of urban agriculture globally.

3.1.i Aggregate employment effects of urban agriculture

In this section, we examine the aggregate impacts of urban agriculture from the perspective of jobs created in the subsector. Those involved in urban farming are rarely formally employed in that activity, though they may have other formal-sector jobs. The paper earlier described the magnitude of the informal employment sector, pointing out that accurate statistics are generally not available. This is particularly true at a subsectoral level, though progress has been made in estimating the magnitude of informal employment at city level.

Table 2: ***Employment in urban and periurban griculture***

City and year of estimation	UPA employment share (in %)	Total employment	Wage-labour employment
Dar es Salaam, 1999		35,000 households	
Shanghai, 1999		3.6 million jobs	
London, 1999	0.04 of labour force	3000 jobs	
Jakarta, 1997	1.0 of labour force	100,000 jobs	92,500 jobs
Sofia, 1999	High, part-time	13,400 jobs	
La Paz, 1997 El Alto area, 1997		3970 jobs 1975 jobs	
Nairobi, 1999	25 of population	150,000 households	
Havana, 1999		117,000 ft and pt	30,000
Mexico City, 1999	1-19 of employed		
Accra, 1999	13.6 of sample		
Dakar, 1999		15,000 official	
Hubli-Dharwad, 1991	20 female 11 male		

Sources: Case studies prepared for this Reader.

3.1.ii Wage labour in urban agriculture

There appears to be relatively little use of wage labour in urban agriculture, except for seasonal work in some areas. Exceptions are Jakarta, Havana, Shanghai and other cities characterised by substantial official support to agriculture and a strong commercial sector. As mentioned above, the statistics on informal-sector labour patterns are not yet disaggregated to a level from which strong conclusions can be drawn. The anecdotal evidence from the case studies suggests what our earlier evidence pointed to at the household level: for most poor urban farmers, the employment market is too fragmented and imperfect for wage opportunities in this subsector to be relied upon.

A study of a small number of urban farmers in Nairobi revealed that they only rarely received volunteer help with agricultural tasks, because most of their family and friends were not interested in this type of work. The study was unclear about whether these farmers considered hiring workers during the busy period, but it is hinted that temporary opportunities to engage in non-agricultural wage labour were more lucrative to the urban farmers themselves than their own farm harvests (Dennery 1996). In a Harare study, 12% of those cultivating in the urban area hired labour to work their fields (Mbiba 1995, cited in Tevera 1996).

3.2 Relationship of urban farming to upstream and downstream economic activities

Urban agriculture contributes to the economy of a city both as a user of inputs (thereby providing a market for products) and as a producer of inputs for other economic entities.

Economists typically examine those input-output relationships using accounting matrices. Analysis of the contributions made by urban agriculture should include informal sector and non-market activities, along with gender disaggregation (see Duchin & Sinha 1999).

Another common approach is to examine the impacts of urban agriculture on related sectors through an impact analysis, or cost-benefit framework. Such methods can point to both positive and negative effects of the urban agricultural activities, and sometimes quantify those impacts (see Nugent 1999a).

Neither of these methods has been extensively developed in analysis of urban agriculture. However, many opportunities to increase these economic linkages are apparent.

3.2.i Urban agriculture as a purchaser of inputs

As a user of inputs (land, water, seeds, chemicals, labour), urban agriculture provides very little economic injection into the local market economy because the inputs used are minimal, often available free and not of high value. These low costs of production are a primary reason that urban agriculture is attractive to low-income people, as they can take up the activity with relatively little investment and operating expenses.

The clear exception to this conclusion is the use of labour in urban agriculture. It was stated earlier that there is relatively little visible use of wage labour in the subsector. Nonetheless, it is clear that unpaid workers with a low opportunity cost, especially female, are relied upon to produce and market the vast majority of the sector's output. As already mentioned, informal employment in urban agriculture can provide supplementary opportunities to the underemployed, temporarily unemployed or chronically unemployed in cities where formal sector opportunities are few.

Most acquisition of other essential inputs in urban agriculture is also outside of the market system, and difficult to value. The primary barrier-to-entry facing urban farmers is not the expense of capital equipment purchases, but access to land. Land is rarely purchased for purposes of urban farming, though a great deal of urban and periurban production takes place on land that once was rural, before city growth encroached onto it. More often, the land used is leased on a temporary basis or obtained informally through customary use.

Land used for urban farming is generally of low value in other uses; i.e., it has a low opportunity cost. Therefore, the contribution may not appear high in monetary terms, but can be seen as producing something of value from a low-value input. When the opportunity cost rises sufficiently, the land is removed from agricultural use (e.g. New York City community gardens). This fact tends to impede any investment for agricultural use of the land, and keeps the land relatively unproductive and thereby of low value in agriculture. One of the greatest risks in urban farming is that the land will eventually become more valuable for other uses and be withdrawn from farming. With appropriate land-tenure alternatives, such as leasehold rights for farming, policies could alter this outcome.

The other important inputs to urban agriculture are seeds, tools, water and fertiliser, most of which are obtained virtually free, thereby contributing little to the economic base of the city. Sometimes, seeds and tools are purchased by urban farmers, providing some revenue to their sellers, but these are used over many years, sometimes shared among farmers, and are not of high value. Often, implements are hand-made.

As with land, competition for water is a serious barrier to urban agriculture in many cities. Clean water is a scarce commodity in most cities in developing countries and is sometimes priced accordingly (UNCHS 1999) Even when water is priced low, the need for clean drinking water is far from met and the highest value is not for agricultural use. Nonetheless, many users avoid legal taps and metres, and obtain the water surreptitiously.

In Mexico City, water scarcity and contamination are among the important factors impeding urban agricultural development (Duque et al. 1999). Respondents to the Harare survey indicated that lack of water or drought conditions were their most serious problem – this applies to both crop farmers and gardeners (ENDA 1998). In La Paz, for instance, some farmers use expensive potable water from the city water supply, others have deep wells installed, and others draw contaminated water from the nearby Rio Choqueyapu. It is recognised that this water use threatens both the farming activities and urban development.

In the many cases where free-flowing water sources are used, contamination is a major concern (see Armar-Klemesu 1999). Stabilisation ponds from the local sewage-treatment plant provided urban farmers in Accra a source of irrigation water until the plant broke down. Raw wastewater is now often used. Studies have shown that lower contamination occurs when vegetables are irrigated with ponded wastewater (primary treatment), compared to vegetables sold in the market stalls coming from rural areas. This is believed to be because of the many incidences of unsanitary handling of vegetables received from rural suppliers.

In Shanghai, low-pressure irrigation systems are installed across a large portion of the farmed land in the city.

One way in which urban agriculture can contribute to the environmental sustainability of cities – as well as avoid costs of waste disposal – is to provide nutrient recycling of organic wastes from numerous urban sources (see Drechsel & Kunze 1999). Organic fertiliser is used by urban farmers when they have access to it, especially in the form of animal droppings and tree clippings. Other inputs used for fertiliser are kitchen waste, ashes, sand and lime.

In Nairobi, 30% of urban farmers use manure that is either purchased or produced by their own livestock. In Dar es Salaam, the supply relationships between poultry keepers and vegetable farmers are well established for fertiliser provision. In Hubli-Dharwad, however, the fodder for urban dairies is purchased from nearby rural areas.

Predictably, the use of chemical fertiliser among urban farmers increases as incomes rise; yet, even among high-income urban gardeners, chemical fertiliser use is low. In Harare, 10% of the highest-income farmers report using chemical fertiliser, compared to 49% who use organic fertiliser (ENDA 1998). However, in this instance again, generalisations about urban farmers are dangerous. In Lusaka, 61% of urban farmers and 78% of periurban farmers report using chemical pesticide, and 50% of urban farmers use chemical fertiliser (Drescher 1996).

3.2.ii Urban agriculture as a provider of inputs

As a producer of inputs for downstream use, urban agriculture contributes to food processing, marketing and packaging activities that generate economic earnings and some employment. For instance, a dozen types of food processing are done in Cagayan de Oro, Philippines (Potutan et al. 2000). In Dakar, the case study reports that downstream activities are a significant economic subsector, though no quantification of the magnitude is provided (Mbaye & Moustier 2000).

However great the potential, downstream activities cannot become significant enterprises contributing to the urban economy as long as the flow of urban food production is uneven and unpredictable. Investments in processing facilities cannot be based on the urban agriculture seen in most cities today. The anecdotal evidence is that the existing activities are small-scale, kitchen preservation and packaging for the market, food preparation for street sale and preservation for home use. In Sofia, most farming households preserve food supplies for winter and small enterprises for canning and preserving food occasionally arise. One area for policy intervention that promises beneficial returns in employment is to create value-added products from the farm through kitchen co-operatives that prepare food for the market.

3.3 Diversification of the urban economy

A less visible but important way in which urban agriculture contributes to local economies is by diversifying the economic base. An economy that is heavily dependent on a small number of economic sectors faces vulnerability to shocks in those sectors. Urban agriculture provides a particularly good buffer against sectoral shocks: people can enter into it easily with few barriers; and it provides food, the most essential commodity in times of economic downturn.

This raises the important point of social and environmental benefits and costs from urban agriculture (see Nugent 1999a for analytical approach to measuring social and environmental benefits and costs). These aspects are covered in other papers for this workshop. It is sufficient to point out that there are clear social benefits (diversification of economy, community cohesion, reduction of food insecurity, etc.) and costs (illegal land and water use, theft of output) that should be considered in policy discussions about the future of urban agriculture.

3.4 Summary of macroeconomic impacts of urban agriculture

The conclusions that can safely be drawn from the studies are consistent with the lessons drawn from looking at the household-level effects of urban agriculture. That is, urban agriculture can make a difference to those who use it as one among an array of strategies. Furthermore, where it is encouraged by policy, it can provide a very significant portion of food needs. Yet it is unlikely to be a major economic driver in any city, even in one where it is heavily supported. In Havana and other cities where urban farming contributes importantly to relieving food insecurity, the potential for a greater macroeconomic contribution must be weighed against the costs of supporting the activity. In most cities, these (economic) costs are low and the benefits of ameliorating food insecurity are high.

The major macroeconomic effects of urban agriculture are provision of food of value to relatively poor urban dwellers, lower food prices, and increased food security. The evidence on the magnitude of the latter two effects is weak, in the sense that these impacts have not been carefully measured across a broad spectrum of cities. Nonetheless, they are strongly implied. In the process, urban agriculture diversifies the economic and food-access opportunities of the urban population.

Urban agriculture also presents a plethora of missed opportunities. Agricultural productivity appears to be extremely low, the labour market ad hoc and mostly voluntary, and downstream processing enterprises relatively insubstantial because of the unreliability of inputs.

The net contribution of urban agriculture to a city’s liveability seems positive – otherwise, we would have to ask why so many people engage in it. Yet the contribution to a city’s economy seems far less than the potential, given all the resources involved in the subsector. What is needed is to find ways to improve the productivity of these resources – especially labour – in order to increase returns, provide a steady and predictable flow of output, and create real opportunities for urban dwellers seeking a liveable existence in growing cities of the world.

4. Urban policy issues and recommendations

The presence of agriculture in the urban environment affects the local economy, the natural environment, social relations and household economic behaviour. It may contribute to the liveability of the city, adding diversity and a safety net, or it may detract from liveability, creating health risks and misusing scarce resources.

At a macro level, the most critical economic policy needs are those that create sound and supportive infrastructure – specifically directed at efficient market and non-market transactions, and reaping social benefits. At a micro level, policies should address households' incentives by providing timely and accurate information, reducing uncertainties, and increasing the efficiency and productivity of urban farmers by assuring resource needs and streamlining market opportunities.

Specific suggestions to address these needs are discussed in turn.

4.1 Policy responsibility for urban agriculture

Local governments and their agencies are the most important policy influences on the viability of urban farming. These authorities are responsible for determining where an activity can occur, if at all, through zoning; what resources are available and in what condition; provision of informational services and orderly marketing arrangements; and provision of a secure legal and economic environment (Van den Berg 1997).

The current policy treatment of urban agriculture at the municipal level is mixed, with a tendency toward suspicion about its uncontrolled nature. Livestock rearing is more restricted than crop production in most places, but some cities prohibit all agricultural activities (Kampala, Lusaka), or require permits and impose restrictions on farming methods (Harare). Whether official regulations prohibit, restrict or ignore urban agriculture, municipal officials often treat the activity with benign neglect (e.g. Nairobi, more recently Lusaka). However, there are significant contrary examples. In Ho Chi Minh City, Mexico City, Shanghai, Jakarta, Havana and Accra there are municipal laws, urban gardening offices and/or extension services that promote and regulate urban agriculture. Van den Berg (1997) points to support in Durban and Cape Town, South Africa, for community gardening. Armar-Klemesu and Maxwell (1998) describe supportive programs in Accra for urban gardening, including a newly established office to manage and co-ordinate assistance to farmers. Until recently, there was no policy concerning agriculture in Mexico City (Duque et al.1999). In September 1998, a new law created a commission to monitor land and soil, and to resolve conflicts over agricultural uses. The law explicitly addresses urban agriculture within Mexico City, in addition to periurban production issues. This kind of recognition could lead to further developments.

4.2 Policies related to infrastructure

Infrastructure is defined for this section to include physical and informational facilities, which are most often provided by public authorities because their benefits have the nature of being public goods. It also includes other municipal services normally provided by public authorities. These services and facilities together determine the nature and efficacy of a city government’s activities and are paramount in contributing toward the liveability of a city.

4.2.i Public infrastructure and land-use planning

The infrastructure and land-use policies needed by urban farmers are scarcely different from those that support other industries. Farmers need safe and adequate transportation for goods and people, including a well-planned road system between the farming land and residential areas and road linkages between rural and urban areas. They also need reliable public utility services (water, wastewater with appropriate level of treatment for re-use, waste collection and disposal, and electricity). Finally, they need land-use regulations and planning that allows proximity of needed services and inputs at reasonable prices – including labour and wholesale and retail food markets.

Such an infrastructure is costly to provide in a large city, but practically prohibitive in most developing country cities that are experiencing fast population growth. Policy-makers must realistically assess the needs urban farmers have for these resources and consider feasible alternatives to expensive infrastructure. This means that solutions must be identified that encourage small-scale, inexpensive systems designed to address directly the most serious problems. With relatively little investment, such efforts can greatly increase the productivity of urban farms. One innovation to consider is to include farmers in stakeholder discussions of zoning decisions.

Small-scale solutions to problems of waste could include establishing convenient collection points for organic waste and small-scale distribution systems (carts or 3-wheeled trucks) to deliver it periodically to farm plots. Another successful system is the use of ponds for primary wastewater treatment, along with hoses or trucks that convey the water in a sanitary manner to urban or periurban farms.

4.2.ii Markets and information systems

A lack of knowledge among small-scale urban farmers impedes their access to markets or prevents them from producing for markets, even when it could be lucrative to do so. This can happen because small producers are not welcome at established markets, or because they do not know what consumers prefer or what prices their products would obtain in the official market. They also have little training or time to assure the quality of their products, often only primitive means of packaging and transporting to market, and little choice among market outlets (Drechsel & Kunze 1999).

As a result, most small farmers are more oriented toward providing supplementary food for their families, rather than investigating the potential returns from the resources they put into farming (Van den Berg 1997). While we have established that factors apart from income-maximising behaviour influence household choices for urban farming, the market imperfections faced by small farmers are a serious impediment for those who wish to earn income in the market. Agricultural field schools and extension services oriented to the needs of urban farmers should be established.

Among the small-scale solutions to be considered are areas for decentralised market activity adjacent to targeted residential neighbourhoods and along transportation routes from urban farming zones. Further, urban farmers could increase their market power by developing co-operatives for marketing their output. These co-operatives could also be used for sharing packaging, processing and transportation costs (see also the marketing recommendations from the FAO Regional Programme “Food Supply and Distribution to Cities”).

4.2.iii Policies addressing urban uncertainty

The most serious problem faced by urban farmers is medium- to long-term access to the critical resource of land. Lack of secure land tenure creates disincentives for urban farmers to invest in productivity-increasing measures, including improved mechanisation, better-quality seeds and soil amendments. Such measures would eventually lead to greater and more predictable output, more employment opportunities and greater potential for linkages to downstream agroindustrial activities.

The conditions for acquiring land for agriculture in cities are often informal and should be regularised. Among the solutions are medium- to long-term lease possibilities, land-swaps in cases where development encroaches on previously farmed land, and public guarantees of zoning that maintains green areas and space for agriculture.

Policy can also address the uncertainty faced by urban producers who wish to market their output by identifying viable downstream microindustrial activities that would add value to the basic foodstuffs being grown, as well as create semiskilled labour opportunities. As mentioned above, an important element of this overall policy solution is to create an environment where access to needed resources, along with a variety of suppliers, will assure these agroindustries a consistent availability of raw materials for processing.

4.3 Policies addressing micro-level household behaviour

4.3.i Provision of public services at the micro level

At the micro level of the household, policies should also be oriented toward efficient and timely provision of services which the market fails to provide, or where there is a public-good component. For instance, providing accurate market information at the level of the individual farmer can be instrumental in clarifying incentives for farmer choices, such as commodity selection and timing of production. Government authorities can also provide technical support and training through extension services geared to the needs of urban farmers, and help farmers become well-versed in the preferences of the urban consumer.

4.3.ii Provision of credit and other resources

A lack of market power can also be addressed if local governments encourage access to credit for small farmers. Currently, little or no credit is available because no collateral is offered and/or because urban farmers are poor women – both major impediments to gaining credit. As a result, if the small farmer works with a market trader to sell produce, she is often obliged to accept short-term credit from that person on terms that might be disadvantageous to her (Van den Berg 1997).

The purpose of small loans is to acquire additional capital or seeds or even as an advance on production to meet cash-flow needs of the household. In these cases, the farmer often falls on the mercy of the traders, who take high risks themselves, but usually can pass them on through higher prices (FAO 1998).

The growing micro-credit industry is tailor-made for urban farmers. Its primary goal is to support income-generating activities of poor women. Micro-credit organisations have proliferated in recent years around the globe and are available in rural and urban areas. Local governments can facilitate the availability of micro-credit for urban farmers by eliminating official barriers to farming, creating access to formal market outlets for selling, and helping to form partnerships between farmers and small agroprocessors that can guarantee revenue streams for the farmers.

5. Final conclusions and implications for policy-makers

Many policy options have been described briefly in the preceding sections. The net result of these policies would be to establish urban farming as a legitimate and viable economic activity in many cities. This could mean that, over time, urban households would look upon agriculture as one among many choices of economic activities that could supplement income from formal jobs, or provide informal market income or enhance household food supply.

Under such conditions, the activity of urban farming would require certain kinds of investments and skills, and provide predictable returns. The greater the degree to which the output can be commercialised, the greater will be incentives to increase productivity, respond to market demand and improve earnings. Concurrently, conditions and productivity will improve for those urban farmers who wish only to provide for their families, resulting in less effort to increase food security.

This scenario presupposes a positive policy environment that minimises uncertainties faced by the farmers and the industries they supply, and provides the means to manage risks, including credit and insurance. Beyond the household and subsectoral level, policies should also address urban agriculture holistically, as part of the entire urban food system. This includes rural-urban supply linkages, food trade and sometimes food aid. Also influencing the urban food system at a macro level are underlying trends in demographics, economic cycles and forces affecting land development in cities. In turn, the presence of urban agriculture creates impacts on the environment, on social relations, and on household economic and cultural behaviour.

A holistic perspective for policy-making would take into account the macro, sectoral and micro relationships, and consider the following in policy development:

- incentives facing households regarding food production and consumption;
- resources available to local government in providing infrastructure and services;
- trends in regional and national agricultural markets, especially supplies; and
- linkages between urban, periurban and rural farmers and processors.

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URBAN AGRICULTURE AND FOOD SECURITY, NUTRITION AND HEALTH

Margaret Armar-Klemesu

1. Food security: concepts and definitions

The concept of food security has been on the international agenda as far back as 1948, when the Universal Declaration of Human Rights affirmed that "Everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food….." Article 11 of the International Covenant on Economic, Social and Cultural Rights went further, in 1966, when it affirmed the "right of everyone to be free from hunger". This right to food is even characterised as a "fundamental right" and is acknowledged as the primary economic right of a human being. This global concern heightened after the 1974 World Food Conference, when diminishing world food supplies and large-scale food shortages triggered responses in the international community that focused on increasing domestic agricultural production and creating international grain reserves. Food security was identified with commercial food prices and physical food availability, rather than with demand and consumption, especially by the poor and vulnerable.

With the realisation that the problem of hunger has more to do with inequalities in distribution and that increased food production was only part of the solution, the concept of food security has shifted from simply being a question of availability of food (at the national or even local level) to the more complex issue of access (at the household or individual level). The current definition, which incorporates issues of adequacy of food, supplies, stability of supplies and secure access to available supplies thus evolved. In 1986 the World Bank further added the dimension of activity level and defined food security as "secure access at all times to sufficient food for a healthy and active life" (World Bank 1986).

At the household and individual level, the concept of adequate food is considered in both quantitative terms (i.e., caloric sufficiency) and, even more so, in qualitative terms (i.e., variety, safety and cultural acceptability). Similarly, household food security depends not only on the availability of an adequate and sustainable supply of food but also on the means employed by households to acquire the needed food.

Stability of household food supplies depends on the ability of a household, even when faced with unpredictable crises, to procure through income, production and/or transfers of adequate food supplies on a continuing basis. The UN ACC/SCN in 1991 came up with a rather more comprehensive technical definition which states: "A household is food secure when it has access to the food needed for a healthy life for all its members (adequate in terms of quality, quantity, safety, and cultural acceptability), and when it is not at undue risk of losing such access" (UN ACC/SCN 1991, 10).[1]

1.1 Urbanisation and food security

Urbanisation is an inevitable consequence of socio-economic development, but in many countries it is proceeding at such a fast rate that it is outpacing the growth of services and employment. In most developing countries, especially those in sub-Saharan Africa, urban poverty has been on the increase with increasing urbanisation for the following reasons:

- rapid population growth;
- economic recession; and
- structural adjustment policies that have reduced government spending and decreased employment opportunities.

Urbanisation also influences all aspects of food production and consumption. Specific aspects of food security applicable to the urban context include (i) the necessity to purchase most of the food needed by the household; and (ii) greater dependence on the market system and on commercially processed food. Wage employment and monetary income are therefore the main prerequisites for achieving food security. However, the majority of urban dwellers, especially those in developing countries, are highly disadvantaged with limited purchasing power, as most are engaged in very low-paying employment in the informal sector.

It is claimed that the world's resources are adequate to produce enough food for its population for at least the next few decades and that, although food supplies are projected to increase faster than population growth in higher-income developing countries, many lower-income countries with the highest levels of poverty will remain vulnerable to food insecurity. More importantly, the majority of the people who cannot

1 United Nations Administrative Co-ordinating Committee/Sub-Committee on Nutrition

meet their nutritional needs will be living in urban areas.

1.2 Urban food systems and urban food security

In terms of access to food, the most significant difference between urban and rural areas is that people in rural areas can often produce their own food, while people in urban areas are more dependent on food purchases. For the urban poor, it is the dominance of the cash economy over access to such a basic need as food that links urban food systems to poverty and vulnerability to food insecurity. With regard to urban food systems, the following are the main factors that determine the urban dwellers' access to food:
- macroeconomic policies;
- employment and cash income;
- markets and food prices;
- urban agriculture.

1.2.i Macroeconomic policies
Macroeconomic policies can significantly influence urban dwellers' access to food both directly and indirectly. These include the increasing lack of employment opportunities, rural-urban migration, urban expansion, rising land prices and the resultant lack of available land for local production and, most importantly, the price of urban food.

For many years, urban dwellers have benefited from "cheap food" policies, including widespread subsidies, overvalued exchange rates and trade restrictions that have kept the price of urban food low. It became necessary during the 1980s for many developing countries to adopt structural adjustment policies that were intended to revitalise economic growth and employment, which are the crucial ingredients for food security of the urban poor. In the short term, however, these measures – which called for a reversal of many of the urban-biased policies – only aggravated the food-security problems of the urban poor (Demery & Squire 1996, Sahn et al. 1996).

During the period of economic decline and the subsequent reforms instituted in the 1980s and 1990s in most of sub-Saharan Africa, a wide range of case studies showed that urban food prices rose more than the general cost of living and more than incomes (von Braun et al. 1993). In Kampala, for example, 60% of the minimum wage was sufficient to provide food for a household of four in 1972, but by 1988 the entire monthly minimum wage purchased enough food to last the same household only about four or five days (Jamal & Weeks 1993). These changes have increased the vulnerability of the urban poor in terms of food security.

1.2.ii Employment and cash income

Most of the food consumed in cities must be purchased, and poor families can spend as much as 60-80% of their income on food (Tabatabai 1993, Maxwell et al. 1999). The ability to earn a cash income is a significant determinant of urban food security, and perhaps the biggest challenge urban dwellers face is that the majority of them work in sectors where wages are low, working conditions precarious and job tenure insecure. In urban sub-Saharan Africa, employment in sectors that pay regular wages accounts for less than 10% of total employment (Rondinelli & Kasard 1993).

1.2.iii Markets and food prices

With the urban dweller's dependence on purchases in the market for food, food prices are another important determinant of the urban household's access to food. Food prices depend on a number of factors, the most important being the efficiency of the food marketing and distribution system. Urban food distribution systems are highly diverse but not especially well integrated, leading to higher prices. As the demand for food rises in urban areas, food supply and distribution systems (FSDSs) have to supply the inhabitants of cities with increasing amounts of food often coming from distant production centres. From harvesting until the moment the produce reaches the urban consumer's table, a whole series of interventions (handling, processing, packaging, transport, storing, marketing, etc.) adds to the price at each stage, and to the amount it costs consumers to feed themselves. Food losses between the production and retail stages are estimated to range from 10 to 30% and are caused by a combination of on-farm, transport, distribution and spoilage problems which are greater in urban than rural areas. All these factors will increase the pressure on existing FSDSs and raise supply and distribution costs, in which transport often plays a major role. Surveys of prices in five developing countries showed that city dwellers paid 10-30% more for food than rural dwellers (Newland 1980). This figure is likely to have increased in recent decades.

Expansion of cities, and the tendency of urban planners to follow the complex highly capitalised and energy-consuming supermarket model of food distribution, affect almost all aspects of food retailing in cities. These supermarkets are placed in the more central locations, out of the periphery. This has not only had serious consequences in terms of infrastructure, transport and storage requirements; it has also resulted in many poor urban neighbourhoods becoming food-retailing deserts, where access to good food shops and markets is rare (Garnett 2000). In the context of the problems posed by urbanisation and structural adjustment, this capitalisation of the conventional food supply system in Third World cities has posed huge problems for the poor. The rising costs of food retailed through these outlets have forced the urban poor to fall back on the informal, petty-commodity or non-conventional sector, which includes the retailing of both fresh and processed produce as well as ready-prepared or street food.

1.2.iv Urban agriculture

Over the past couple of decades, urban agriculture has increasingly gained recognition as a viable intervention strategy for the urban poor to earn extra income. It also allows the poor to reduce their reliance on cash income for food by growing their own food on plots inside or outside the city, thus increasing their access to much needed food.

It must, however, be noted that urban agricultural activities, while being an important strategy for self-provisioning, especially for poor households, have not always been a response to household economic crises. The more highly developed commercial urban farming is a major component of the urban food system, supplying urban residents with the more perishable fresh vegetables and animal products and by-products such as poultry, eggs and milk, and providing the diversity needed to ensure dietary quality – an important aspect of food security.

2. Urban agriculture and food and nutrition security

2.1 Urban agriculture and food security

The scale of urban food production is generally underestimated. According to the most widely accepted estimate, about 200 million urban dwellers now participate in urban farming, providing 800 million people with at least some of their food (Nelson 1996). Conservative estimates suggest that, in 1993, between 15 and 20% of the world's food was produced in urban areas. Although numbers are difficult to come by, it is further estimated that as much as 40% of the population in African cities and up to 50% in Latin America are involved in urban agriculture (Mougeot 1994). Urban agricultural output ranges from staple crops like maize, cassava, plantain and vegetables, including local varieties of tomatoes, peppers, leafy vegetables and the more exotic lettuce, cucumbers, cauliflowers and carrots, to livestock such as cattle, goats, poultry and small ruminants.

Urban agriculture contributes, in no small measure, to the food security of many major cities, both as an important component of the urban food system and as a means for vulnerable groups to minimise their food-insecurity problems. City case studies indicate a considerable degree of self-sufficiency in fresh vegetable and poultry production as well as other animal byproducts. Using a productivity level of 10.7 t/ha, London is estimated to produce around 232,000 t of fruit and vegetables (Garnett 2000). Sofia's daily sales of produce at its open markets are estimated at about 1000 t (Yoveva et al. 2000). Dakar produces 60% of its vegetable consumption, whilst poultry production amounts to 65-70% of the national demand (Mbaye & Moustier 2000). In Accra, 90% of the city's fresh vegetable consumption is from production within the city (CENCOSAD 1994). In Dar es Salaam, more than 90% of leafy vegetables coming to the markets have their origin in the open spaces and home gardens (Stevenson et al. 1996).

In terms of meeting household food needs, urban agriculture in Harare is estimated to provide families engaged in the activity with staple food for up to four months in a year (Mbiba 1993). Figures for Accra range from between one and eight months (Zakariah et al. 1998). Kampala residents living within a 5 km radius of the city centre produced about 20% of the staple foods consumed within that same area (Maxwell 1994).

Studies that have undertaken actual measurements of the impact of urban agriculture on food security generally support the hypothesis that urban agriculture does improve the food security of vulnerable households. Mwangi (1995) compares farming and non-farming households in low-income neighbourhoods in Nairobi and notes that, while mean consumption is well below estimated requirements in all cases, farming households are better off in terms of both energy and protein consumption, and that farmers participating in an organised urban agriculture support program are significantly better off in both categories. The farming households produce 20-25% of their food requirements and are significantly less dependent on gifts and transfers. Sawio (1993) reports that nearly 50% of 260 Dar es Salaam residents indicated that urban agriculture provided 20-30% or more of their household's food supply. In

Kampala, 55% of 150 producers obtained 40% or more and 32% obtained 60% or more of their household food needs from their own urban garden (Maxwell & Zziwa 1992). In Harare, a disaggregated profile of self-produced food consumption and its variation by income indicated that 60% of food consumed by a quarter of the low-income group was self-produced (Bowyer-Bower & Drakakis-Smith 1996).

Clearly, urban agriculture makes a vital contribution to the food self-reliance of many major cities. As reiterated by Mougeot (1994), food self-reliance is not self-sufficiency, but it can go a long way towards reducing the food insecurity of vulnerable groups. Urban agriculture cannot be expected to satisfy the urban demand for staple crops like cereals and tubers, which can easily be stored and transported with limited losses from rural areas. What must be recognised and appreciated is that urban agriculture, with limited support, already supplies a significant share of food, especially the more easily perishable vegetables and poultry products, to many cities.

Fresh vegetables, for instance, make up an important component of diversified diets, improving dietary quality. They can also be one of the most expensive items in the urban consumers' food basket, given the costs incurred in their marketing, in terms of transportation from producing areas and the sheer quantities that perish during transportation. The marketing channel is an important factor in the cost of food, and the location and extent of local food production may shorten the path of distribution from producer to consumer. Cost-benefit analyses of market vegetable crops in Lomé and Bissau have shown that net incomes are higher where there are fewer middlemen (Schilter 1991, cited in Mougeot 1998). Vegetable wholesalers in a major distribution market in Accra, when interviewed, stated categorically that they preferred buying their produce from local producers (personal observation).

Food growing in cities can and does help improve the quality of people's diets by providing fresh fruits and vegetables, particularly to people in the low-income bracket. The Cagayan de Oro study (Potutan et al. 2000) shows that urban farmers generally eat more vegetables than non-urban farmers of the same wealth class and also more than consumers from a higher wealth-class (who consume more meat). Urban dwellers in most cities in the developing countries have a high dependency on ready-prepared meals, popularly referred to as "street food". Vending of street food has become an important component of the urban food supply system. Local food production can be an important source of supply of fresh vegetables for street food preparation. Contrary to the traditional food consumption pattern of the Ghanaian, which frowns on the consumption of raw vegetables, fresh salad preparations have increasingly become an integral component of rice-based street food sold in Accra (personal observation). This is a clear departure from the popularly held view that fresh vegetable consumption is the reserve of expatriates and the rich (CENCOSAD 1994).

Being mindful of the fact that food security encompasses quality and not only quantity, local food production is an important component of food security and must be seen as complementary rather than competitive to other urban food supply systems.

2.2 Effect of urban agriculture on the nutritional status of vulnerable groups

Whilst it can easily be inferred that better access to food and greater dietary diversity will improve the nutritional status of vulnerable groups, very few studies in African cities have attempted to rigorously test the link between urban agriculture and nutrition by comparing the nutritional status (assessed by the height-for-age, weight-for-age and weight-for-height indicators) of children aged under five, from farming and non-farming households.

Ogden (1993) reported various indicators of pre-schooler nutritional status in her study of urban food security in Kigali, and noted that urban agriculture was positively associated with nutritional status in some income groups, and under some conditions of maternal employment. In Nairobi, Mwangi (1995) reported few differences in mean nutritional status (expressed as a percentage of the expected mean). Children from non-farming households were somewhat more likely to be moderately malnourished.

Maxwell, Levin and Csete (1998) report the linkages of urban agriculture and malnutrition in Kampala. When controlling for socio-economic status and other individual and household characteristics, they found that urban agriculture is positively and significantly associated with higher nutritional status in children, particularly in terms of height-for-age, and that there is a significantly lower proportion of moderately to severely malnourished children in households where someone (almost always the mother or primary care-giver) is farming. They suggest that the impact on nutritional status is a result of both higher and more stable access to food on account of virtually year-round availability of staple foods from urban production, and the ability of mothers who farm to provide more direct childcare than women engaged in other economic activities.

With the exception of the Kampala study, these studies generally do not provide conclusive evidence of a positive impact of urban agriculture on nutritional status of children. Several reasons could account for this. Most of the studies based their conclusions on differences in height-for-age (indicator for stunting), which is a measure of long-term chronic undernutrition and a reflection of poverty. More importantly, food intake is only one determinant of nutritional status of children - others being the quality of care provided and the incidence of disease (UNICEF 1990). Without adequate knowledge of the role of these other factors, caution must be exercised in the interpretation of these results.

2.3 Innovative approaches to enhance local food production and improve food distribution systems

Limited access to productive resources in terms of access to land, security of tenure, availability of water and other inputs are major constraints to local food production. Provision of technical support to farmers through extension services is necessary for the enhancement of local food production. Extension workers can play a very useful role as a link between farmers and other service providers or projects. They can act as important channels to disseminate information to farmers on training and more sustainable, bio-intensive farming methods that can enhance local food production. Such methods include hydroponics, use of organic pesticides and composting with organic waste.

Hydroponics, for instance, is gaining popularity as a solution to the problem of access to land for urban farming. Urban farmers in Mexico, Lima and central Santo Domingo are using the most unconventional of spaces, such as balconies and rooftops, for food production. "Organoponics" is a production technique applied by state-owned gardens which involves raised container beds with a high ratio of compost to soil and intensive planting of vegetable crops. This method is particularly useful for vacant lots that have been paved over with concrete or where the soil is extremely poor or hard to plough.

Composting of organic waste from harvested produce of farms, markets and urban households to enhance soil fertility is not only gaining popularity but is also being recognised and strongly advocated as a viable alternative to dealing with the problem of municipal waste disposal. The use of organic pesticides such as the neem tree (*Azadirachta indica*), as is currently being tried in Accra, is another innovative way of producing safer crops in a non-polluting way.

In terms of food distribution, Community Supported Agriculture is an innovative system of direct linkage between urban producers and consumers. The idea is that a group of consumers pays a fixed price to the producer in exchange for a weekly vegetable box or the right to harvest a certain amount of produce. Developing a relationship with the farmer, the consumers can express their production wishes and are often prepared to pay a bit more. At times, they also pay in advance (before the growing season), so that the producer does not need to borrow money to make investments. The producers are secured of their sale and the risks are shared between producers and consumers (in case the harvest is less, each consumer receives less). Good examples are given by WSAA[2] (1996). In Accra, the city authorities are putting measures in place for the establishment of Saturday markets purposely to enable urban vegetable farmers to sell directly to consumers.

3. Urban agriculture and health

3.1 Health risks related to urban agriculture

Health issues in urban agriculture are mainly related to pollution, both chemical and biological, of food prior to harvesting and possible contamination during marketing and distribution. Human and environmental health risks of inappropriate urban agricultural practices arise from the following:

- inappropriate handling of agrochemicals by producers;
- crop selection or location without due regard to the ambient pollution in the air, soil or water;
- livestock production;
- application of unsorted or insufficiently treated solid and liquid organic wastes to vulnerable crops; and
- poor handling during marketing and distribution.

Food products are one form of human ingestion of toxic products. The WHO Surveillance Programme for Control of Food-borne Infections and Intoxications in Europe has reported a dramatic increase in food-borne diseases over the last ten years.

Indiscriminate use of agrochemicals such as fertilisers, insecticides, pesticides and

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herbicides may significantly increase agricultural yield, but the residues from them can also have negative impacts on the environment and on human health. Along with potentially toxic levels of chemical farm inputs used in agricultural production, crops grown on polluted soils and in the vicinity of rail, roads and industrial areas can be contaminated with heavy metals (mostly lead), pesticides, sulphur and nitrate. These toxicants affect the nervous, digestive and circulatory systems, particularly threatening the health of young children. Lead is probably most dangerous for children, as it interferes with their vitamin D production and mental development. Fundamental factors determining the presence of these metals and toxicants in agricultural produce are the distance of the production area from the source of pollution and the duration of exposure to the toxicants. Also the type of crop grown determines the potential contamination. In general, leafy vegetables and crops with a longer growing period are the most sensitive. Several surveys on quality of soils and vegetable production show that large areas are polluted in Sofia, Bulgaria. More than half of 34 soil samples taken from farmland and backyards in “Novi Iskar” in Sofia had lead concentrations in excess of 1.5 times and up to 14 times the limits allowed.

Livestock production in cities can also be a potential source of health problems. Livestock is an important carrier of parasites, bacteria and viruses that are dangerous to human health. For example, cattle, sheep, goats, pigs and horses are important reservoirs for Cryptosporidium parasites, excreting them in their faeces. Known routes of transmission are animal-to-person, consumption of animal produce and faecal contamination of the environment, particularly by fertilisation of crops with sewage sludge or wastewater irrigation.

Foods most often involved in disease outbreaks are raw or insufficiently cooked meat, milk, poultry and eggs (salmonella).

One of the main beneficial impacts of urban agriculture is the potential to recycle urban waste products. Organic waste, such as waste from harvested agricultural produce and animal manure, is popularly used as compost. While this is certainly a favourable practice, attention must be given to health risks from the handling and application of manure from vector-carrying animals. Use of composted domestic waste also poses health risks if the trash has not been sorted properly. There is also the danger of polluting the soil if the compost is used on land for vegetable production. The use of untreated wastewater for irrigation purposes is a cause for considerable concern. In the developing world, some 90% of all sewage is discharged, along with the faecal coliform bacteria that cause intestinal diseases, directly into rivers, lakes, streams and coastal waters (Nelson 1996).

In most cities in the developing world, these water bodies may be the only source of irrigation. In Nairobi, the majority of plots farmed are located along the Nairobi River, which is heavily contaminated with both industrial and human waste (Foeken & Mwangi 2000). Vegetables are grown along the banks of Accra's streams and drains that carry much of the wastewater in the city. These waterways are heavily polluted, with both human and industrial waste. Because alternatives are lacking, wastewater from these drains and streams is used to irrigate vegetables. Studies carried out in Accra showed a high incidence of faecal pollution and microbial contamination along the banks of streams and drains used for watering vegetables (Amuzu & Leitmann 1992). In related studies on food contamination, lettuce was found to contain the highest levels of contamination of all vegetables examined in Accra (Akpedonu 1997, Abdul-Raouf et al. 1993). This is not an altogether surprising finding, as lettuce is a low-growing crop, the edible parts of which are likely to be directly contaminated if irrigated with dirty water.

However, the fear of contaminated urban grown food, whilst legitimate, should not be exaggerated. For example, tests carried out by the Russian State Committee on Standards showing almost identical results to those of Cornell University in New York: crops grown on rooftops in urban areas contained up to ten times less contaminants than produce bought at local markets or grown on suburban plots. The potential risks from eating urban-grown food should be balanced against those of eating foods grown in rural areas. These, unless grown ecologically, are likely to have been treated with an array of chemicals. These chemicals are used not only in producing fruits and vegetables, but also in producing meat and dairy products.

3.2 Innovative and effective approaches to manage health risks of urban agriculture

Potential negative health effects of urban food consumption can be minimised by adopting least-risk farming strategies. Improvement of least-risk farming with low-cost measures requires awareness and willingness on the part of the entrepreneurs as well as supportive government and sector organisations. As both conditions seem to be absent in most countries, this calls for research into the needs of the urban farmers and entrepreneurs, the testing of technical improvements, the development of training material on environmental and health effects, and advocacy involving government, sector organisations and international organisations like the Food & Agriculture Organisation (FAO), United Nations Development Programme (UNDP) and the World Health Organisation (WHO).

Least-risk farming strategies may include:

- crop choice: For example, the metal absorption ratio in plant parts is (fruits + seeds): (leaves + roots) = 1:10, showing that fruits and seeds are ten times safer to grow and consume than leaves and roots. Celery, parsley, leek, lettuce, spinach, carrots, beets and radishes are not advisable to cultivate on heavily polluted soils, on account of their high uptake of heavy metals and nitrate. Gourds, onions, garlic and fruit trees and shrubs offer lower risks. In severely polluted areas, growing non-edible plants, flowers and products for industrial use should be considered. However, the return on such crops may be lower and the markets less well understood and trusted (Polish Ecological Club, Gliwice Circle 1993);

- use of cash crops or bio-remediation (using plants that take up toxic waste): The Henry Doubleday Research Association (United Kingdom) publishes a list of hedging species which can take up pollutants in the soil and act as barriers to airborne pollution. In Germany, good results are obtained with the use of reed species that take up a large amount of heavy metals from polluted soils and waters. The reeds are later used in construction/building;

- location of production: Lead concentrations in food items vary greatly depending on location (distance to road and railways), emission sources (air pollution through traffic can contaminate leafy vegetables) and processing methods (leaf contamination can be rather easily removed through washing or scraping of produce). Vegetables grown in industrial and mining areas or close to roads suffer from a higher atmospheric deposition of lead particles. Mengel and Kirkby (1987) mention that the lead concentration in vegetables grown next to streets is 5-20 times higher within a distance of 50 m from the roads. On the other hand, Smit et al. (1996) suggest that a distance of 7.5 m minimises this effect; and

- other possibilities involve adoption of farming techniques that prevent contact with contaminated soil altogether by growing crops in containers or raised beds with growing media or by using hydroponics, or preventing or reducing heavy metal uptake by maintaining the pH level of the soil above 7.5 (by adding basic organic matter or lime) .

Technologies needed to effectively deal with the problems of using recycled urban organic waste and wastewater do exist and should be promoted to enable the adoption of safer agricultural practices. Such technologies include the biological treatment of wastewater for irrigation purposes. Minimising the use of pesticides and other agrochemicals will go a long way in managing the health risks associated with the use of such chemicals. An innovative approach using the neem tree to control insect and pest infestation is being tried among vegetable farmers in Accra (personal communication).

Raising animals in proximity to or in the midst of homes and workplaces can cause a variety of health problems through transmittance of epidemic diseases or contamination of water sources (animal manure). Preventive measures are related to clean animal housing, adoption of hygienic measures (feed, manure handling, cleaning and disinfection) and, when appropriate, vaccination. More importantly, regulations and monitoring are vital to ensure appropriate animal husbandry practices in urban areas.

4. Implications for urban policies and programmes

The main constraints to the development of urban agriculture have been identified, and possible interventions to address them have been proposed by de Zeeuw (1998). The constraints include:

- prohibitive urban policies and regulation;
- limited access to productive resources and insecure land tenure;
- lack of support services; and
- lack of organisation among urban farmers.

Ellis and Sumberg (1998) have reviewed the literature and categorised policy recommendations into two: those located within the framework of municipal planning, focusing on issues relating to land access and security of tenure; and those more related to sectoral agricultural policy. The latter category focuses on recognition of urban agriculture as farming systems, and especially emphasising access to farm inputs and services that could raise productivity and output.

The analysis from the city case studies provides practical experience and evidence that virtually all the enumerated constraints are not insurmountable and can be effectively tackled. As cautioned by Nugent and cited by Nelson (1996), "urban agriculture, while potentially viable and productive, may not be a panacea to solve the most severe problems of food security in cities and is at best a survival technique for the urban poor". There is general agreement that urban and periurban food production has a role to play in contributing to the welfare of some urban dwellers. More importantly, governments in many cities and towns in developing countries are beginning to recognise that local food production may be an important component of urban food systems and food security.

Generally, the nature and success of any intervention aimed at developing urban agriculture in any city will, to a large extent, depend on the awareness and, above all, the political will of personalities holding various positions in the city administration.

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POLICY OPTIONS FOR URBAN AGRICULTURE

Martin Bourque

1. Introduction

Throughout the globe, agriculture is increasingly a part of city landscapes. Like many urban trends, urban agriculture crosses borders North and South and is evident in both rich and poor countries. It is found in small towns and the major metropolises, and in industrial, financial and governmental urban hubs. It is found in temperate and tropical latitudes, and at sea level and high in the mountains. The United Nations Development Programme (UNDP) estimates that as many as 800 million urban residents are involved in commercial or subsistence agriculture in or around cities (UNDP 1996).

In some cities, agriculture has a very long history, but in most the growth of city farming is a relatively new trend. It is providing new jobs, food and green spaces in some of the most difficult urban environments. Looking over the globe at this new phenomenon, we can see several important trends which help inform us about the nature of this international movement. Most importantly, urban agriculture is growing in the poorest sectors of urban societies as a direct result of the increasing disparities between the global rich and the global poor. Extreme poverty in the context of harsh and stringent structural adjustment programmes, dismantling of social safety nets, and neo-liberal trade policies has driven many of the new urban agriculture movements even in cities where food is abundant. A related trend is the breakdown of rural societies in the wake of these same international policies and the resultant migration to the city of rural people who bring agricultural traditions with them. When the urban environment fails to provide them with sustained and gainful employment in either formal or informal sectors, they turn to what they know best to secure food for themselves and their families.

As a result of these two trends, the initiative for urban agriculture has come almost entirely from the communities where it is found. In almost every case (although there are significant exceptions), it is either individuals, community groups or local non-governmental organisations (NGOs) which have taken the lead in creating productive spaces within the city and its surrounding areas (UNDP 1996). In some cases, foreign universities, NGOs and aid agencies, both bilateral and multilateral, have provided important resources, helping these groups to further their work.

When these community-based groups begin to reach a critical mass of people doing and wanting to do urban farming, they inevitably run into the barriers and limitations of working in an urban environment. These barriers range from access to land, water, seeds and technical support to zoning, public health laws and other municipal regulations regarding agriculture as an activity in the city.

In many cases, the preconceptions of technocratic city planners and managers prevents the expansion and institutionalisation of farms in the city. Agriculture is generally seen as strictly a rural activity and especially the idea of urban animal husbandry brings the worst connotations into the minds of city and health officials. Agriculture in the city goes against their image of modern civilisation and progress. Changing the preconception of city and national leaders and thus changing the policies of the local government and of national agencies will be of utmost importance to the survival, expansion and institutionalisation of local movements. In the most successful cases, some combination of local and national government agencies has come to support the efforts of the city farmers and their organisations.

This paper explores what policy options exist for urban agriculture and what tools may be useful in achieving them. It looks at conceptions of policy and how policy is made, examines the constraints of modern planning processes and suggests strategies for overcoming them. It also suggests that, while working on urban agriculture policy, we must also work on the international development policies which are at the root of problems that urban agriculture is seeking to address.

2. Why is urban agriculture important?

2.1 Benefits of urban agriculture

City farming is one of the strong and positive activities urban residents are undertaking in an effort to take control of food security, social ills and environmental degradation in their communities. It has provided food, jobs, environmental enhancement, education, beautification, inspiration and hope (UNDP 1996; Mougeot 1994).

It is significant because, in almost every case, it is home-grown, decentralised and spontaneous, which means it is fulfilling the goals of the practitioners or they would not be doing it. It is easy to get caught up in the inspirational stories of communities who are producing high-quality food for themselves and other city dwellers with very little capital investment. These small advances must be viewed, however, in the context of the major destruction that many urban and rural communities have suffered in the last decades under debt-driven structural adjustment policies and elimination of government farm supports and social welfare programmes.

In the South, the confluence of many factors such as high unemployment, increased food prices, elimination of food price subsidies, devaluation and the systematic elimination of other social safety nets, combined with non-formal access to open space and the farming tradition that rural migrants bring, has resulted in many local movements across the globe. In the North, elimination of social safety nets has been more gradual and welfare-to-work programmes and new block-grant approaches seek to reduce welfare spending (Mittal & Rosset 1999). In this context, urban agriculture has been used to employ youth, ex-convicts, homeless people and other “at risk” populations.

Like small farming sectors in rural areas, urban agriculture fulfils multiple functions and provides multiple benefits (Rosset 1999). At its best, urban agriculture cleans up dumping sites, educates youth and keeps them out of trouble, provides employment, gives utility and respect to elders, builds community, recycles kitchen and other urban “wastes”, and produces fresh nutritious food. Because virtually all of the other functions of urban agriculture can be fulfilled through other activities, producing food is perhaps the single most important benefit.

In the poorest urban communities, food security is the bottom line on why urban agriculture is important. However, urban agriculture is only one way to solve food-security issues and thus should be viewed in this larger context. Organising around urban agriculture may not always be the best way to address food-security issues, but organising around food-security issues is one of the best ways to promote urban agriculture.

2.2 Urban agriculture and community food security

Urban agriculture can provide a very good "band-aid" to many serious problems. However, it is rarely a real solution to the root causes of hunger. Because of this, it may, in some policy circles, be used as a way out of dealing with real structural issues of poverty, unemployment and malnutrition. In formulating a political strategy for advocacy efforts, this must be considered, as it can be used to trade short-term gains in urban agriculture policy for long-term losses in overall food security policy.

In almost all of the case studies presented in this reader, the driving force behind urban agriculture is decreased food security on account of increased poverty in urban areas. In many of the cases, this has been happening at an accelerated pace in the last decade. Advances in urban agriculture and local food production may be important steps forward, but, viewed in this larger context, may only represent desperate survival strategies in an increasingly impossible policy environment. Thus, when we discuss policy options for urban agriculture, we should keep our eyes on the overarching goal; that is, community-level food security.

In North America, the concept of Community Food Security (CFS) is fast developing as both theory and practice, with many scholars, advocates and activists attempting to create a clear definition and theoretical framework for this movement (Anderson & Cook 1999, CFSC 1999b). Even the US Secretary of Agriculture, Dan Glickman, just signed the Community Food Security Initiative, which outlines the USDA's commitment to mobilising internal resources to promote CFS for all persons (CFSC 1999a). The concept of CFS is relatively new in the USA because it approaches the holistic nature of food security but focuses on efforts that have direct impacts for the community rather than the individual. Urban agriculture is seen as a key element of CFS but only as part of an overall effort which also includes developing closer producer/consumer relationships, supporting the development of other food outlets, protecting farmland from development, supporting rural communities as well as urban, protecting government food support systems, etc.

In Cairo, it is clear from the case study in this reader that the erosion of previous food-security programmes has promoted spontaneous household poultry production. Sources of calories such as bread, sugar and oil are still partially subsidised but protein price supports have been eliminated. Eggs are the cheapest source of animal protein and, also for a host of other reasons, many local residents have begun raising chickens. These efforts have run into neighbourhood and institutional barriers (Gertel & Samir 2000). However, while efforts to change attitudes and policies to support the raising of chickens are clearly necessary, a CFS approach would not stop there. Achieving CFS would require continued efforts to confront the deconstruction of social safety nets and other existing CFS systems. We know that if protein and other foods are no longer subsidised today and everyone accepts this, then eventually the caloric supports will be removed as well. It is much harder to grow wheat on rooftops than it is to raise chickens. Using a CFS framework to address the root causes of food insecurity while, at the same time, addressing immediate needs has proven itself to be an important organising strategy in many cities (Biehler et al. 1999).

3. What is policy?

Policy is a nebulous concept, which often defies definition in practical terms. At its most fundamental level, it is simply an intent. In American English vernacular, as defined by the American Heritage Dictionary, policy is described as:

- *a method or course of action adopted by a government, business, organization, etc. designed to influence and determine decisions;*
- *a guiding principal or procedure;*
- *shrewdness.*

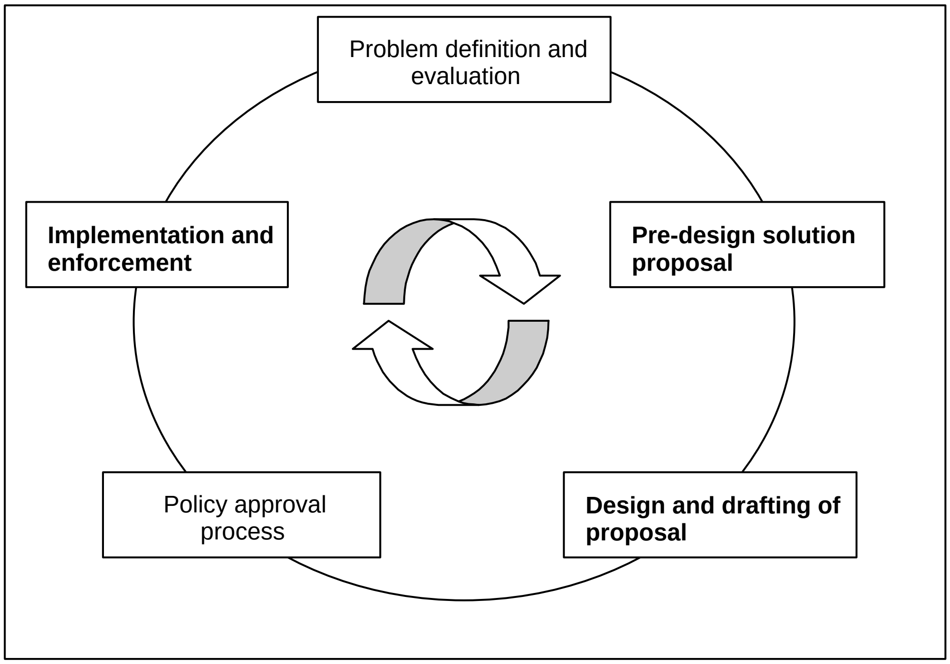
In practical terms, it is the union of laws, regulations, implementation procedures and enforcement actions towards a goal. One way to view it is the sum of the results of the intent, such that whatever is on paper is irrelevant, and thus the definition of a policy is what actually happens in the real world. This view allows for the inclusion of factors not included in official definitions, such as the role of illicit activities and the unspoken limitations of enforcement agencies. Often we think of policy as legislation but, if we dig into what policy is, we see clearly that it is not.

For example, in California the speed limit on highways in urban areas is 55 miles per hour (mph). That is the law. This law was established through a negotiation between the California legislature representing the concerns of its constituents (voters, corporations and other donors) and the Federal Government, which pays for much of the construction and maintenance of freeways. It was designed to meet a commonly held ideal that we should limit the velocity of vehicles on our freeways for safety and fuel economy. However, the policy of the California Highway Patrol (CHP) is both unspoken and not necessarily in line with these goals. On the asphalt, the CHP's policy is that motorists will *usually* not be given tickets unless they are going faster than 65 mph and *generally* unless they are moving significantly faster than the flow of traffic. However, if the motorist is black or "latino", drives an unsightly vehicle or is otherwise suspect to officers' approval, the motorist may be detained for no justifiable reason and ticketed for going just over the speed limit.

The point is that legislation is only one expression of a political intent and that, when laws on the books meet the real world, policy is often determined by those who implement and enforce it. Additionally, enforcement is rarely uniform. In the Harare case study in this reader, it was reported that, even though some agricultural plots were officially registered and condoned, crops in periurban areas are frequently slashed by officials (Mbiba 2000). In Accra, the law states that no one shall use sewage drainages for agricultural purposes yet, since there is no enforcement, the practice is common (Armar-Klemesu & Maxwell 2000).

3.1 How is policy made?

Each community faces a different policy environment, and the way policy is developed, approved and implemented varies dramatically between cities and nations. In the most general terms, policy is made through the creation of political will in both the decision-making body and the implementing agencies for a particular jurisdiction. In an ideal policy environment, the policy-making process would look something like this:



In a perfect world, policy creation would be inclusive, circular and evolving. It would include all stakeholders at each stage of the process and not just during the implementation stage. In the real world, policy-making is usually exclusive, linear and static (or transitory). New paradigms of policy in the last quarter century call for the decentralisation of national political structures and the elimination of government controls for market-based controls. The result at the macro level has been the creation of a very centralised international policy-makers club (WTO (World Trade Organisation), IMF (International Monetary Fund), WB (World Bank), etc.) and decentralised and underfunded national and regional implementation agencies (Bello 1998). Because local, city, regional, national and international policy arenas are often intertwined and overlapping, understanding the relationships between distinct policy arenas will help refine advocacy efforts (UNDP 1996).

3.2 Policy arenas

This reader focuses on local-level policy initiatives but decisions at national and international level affect local policies both directly and indirectly. Good examples are the global trends towards privatisation and decentralisation of government agencies, institutions and utilities. It is very important to recognise which policies are coming from community, national and international arenas, and to understand the relationships between the policies and the agencies. Policies, and their governing bodies, and influential players can be mapped out by using a simple grid like the one below:

	Policy	**Agency**	**Influences**	**Impact**
Local				
National				
International				

This simple grid can be modified to look at different aspects of a problem such as what resources or barriers are involved at each level. There are many different problem-mapping and power-mapping approaches. Whatever methodology is used, these kinds of analyses are especially useful when working in coalitions, because they clarify basic views and assumptions about the nature of the problem, build consensus on what the key issues are, share information and develop relationships (Biehler et al. 1999). They can also help a group define which arena to focus their attention on, or how to approach multiple arenas in an organised manner.

Most policy processes above the community level do not include stakeholders in the early stages of problem analysis and pre-design. They often start at the design level based on assumptions made by policy-makers. So the earlier stakeholders can get in on a process to educate and advocate, the better. The greatest success will be through direct contact and advocacy, winning over a few key policy-makers, getting in at the problem-evaluation stage. Once engaged, it is very important to stick with the process through all the other stages. Keeping policy-makers engaged throughout the implementation and evaluation stages is also important.

This is often seen by direct service groups and community organisations as boring, hard political work that no one wants to do and generally produces few results. It takes resources and constant energy, which many groups would rather expend in other arenas such as project implementation. This explains why most direct initiatives are through private NGOs and community groups working outside the policy arena.

However, there is hope. In many cases, working with local agencies or directly with a municipal or provincial government, collaborative efforts are successful.

Finding the key individuals within a policy arena who are sympathetic to urban agriculture goals or who might be brought around through field visits and education can make or break an effort. Education of policy-makers and their constituents is extremely important in creating political will.

Political will and strong supporting constituencies are perhaps the most important factors in policy-making. Gaining them represents the moment when advocacy efforts begin to pay off. Winning the support of an individual in a decision-making position may be only half the battle; that policy-maker then has to win over other decision-makers as well as the implementers and enforcers involved. In spite of charismatic leaders, bureaucratic inertia can be a much harder force to counter. Organising should therefore include both working on specific policy-makers as well as building coalitions with other groups and agencies.

In some cases where government has played a strong role, serious and punctuated breakdowns in the food system have brought on tremendous shows of political will. The urgency of the crisis creates political will and strong constituencies in both civil society and the implementing and enforcement agencies. These moments inform us on how urban agriculture could look in all of our cities, if the political will of the policy-makers existed. One classic example of this in the United States is the “Glory Gardens” of the 1940s, which were promoted as part of the wartime effort. Food shortages and rationing were a result of putting massive resources into military action, and the urban civilians were told to produce what they could for themselves. Government policy supported this effort until the war was over.

In recent years, we can look to "Operation Feed Yourself" during economic crises of the 1970s in Ghana (Armar-Klemesu & Maxwell 2000), and the urban agriculture policies and programmes implemented after the fall of the Soviet Union in Cuba (Altieri et al. 1999, Companioni et al. 1999). In Ghana, people lost interest as the situation improved during the 1980s; in Cuba, however, the movement seems to have grown in spite of dramatic improvements in food security. What is evident is that, in most cases, government is not going to make these issues a high priority unless there is serious pressure from internal and external forces.

In many of the case studies, such crises exist. Hunger, poverty, malnutrition and disease all exist and are increasingly taking their toll on the urban poor. However, it is a slow and steady erosion of standards of living and not necessarily punctuated in a way that attracts government attention. The challenge for community-based organisations is how to get government programmes in place while their crisis is not being felt by the policy-makers.

Local food-security coalitions can do problem evaluation and bring in policy-makers better than can a single group. Building such coalitions between different groups (labour, housing, environmental, health, etc.) can be difficult and exhausting. However, as all of these issues are related, it creates a place where community-wide strategy can be developed and efforts can join synergistically to produce much larger effects than the efforts of any one sector. In the USA, this type of organising has lead to the creation of Food Policy Councils. These are public entities with strong stakeholder participation dedicated to analysing food-security issues and co-ordinating the actions of diverse public agencies within a given jurisdiction (Pothukuchi & Kaufman 1999, Biehler et al. 1999).

3.3 Policy environment

The policy environment is the union of all the elements that influence policy-making and enforcement. It includes the actual policy-makers and the governmental structures in which they exist, (e.g. both this particular mayor as well as "The Mayor" as a governing institution). It also includes the regional national and international context, and the formal and informal outside influences on that context. Such influences include international institutions, higher-level government, national and international corporations and other market forces, labour organisations, active social movements, crime and graft rackets, etc. The current hot-button issues and recent policy changes in other related areas are also part of the policy environment.
Unfortunately, we do not often get to choose our policy environment. Furthermore, changing the policy environment is a much larger task than advocating within it. In some cases, struggling for such change may be absolutely necessary to bring about any real policy change. In others, the policy environment may be so adverse to urban agriculture initiatives that it is not worth engaging at all, and effort may be better spent seeking how to stay out of conflict with existing agencies rather than how to bring about real change.

It is extremely important to know the policy environment thoroughly. Power-mapping is a way of documenting official structures, informal functioning, who the players are, what their powers and constraints are, and what the relations are between different agencies and other outside influences. When there is a strong knowledge of the policy environment, it is possible to identify the best opportunities for advocacy. When working in a coalition, mapping out all of the collective knowledge can illuminate clear areas of opportunity and areas which are dead ends. Combining this with a priority list of goals can help orient coalition strategy and tactics.

3.4 Policy tools

Policy tools are the methods of creating policy change: the nuts and bolts of how to reach a defined policy goal. There may be several ways to reach any given goal and the real potential and effectiveness of each approach should be considered in detail. Below are some of the major tools currently in use:

3.4.i Electoral processes

Helping sympathetic figures get into political positions through whatever political process exists is a very important way to advance policy goals. Making urban agriculture and food security issues a part of election-campaign debates is also a way to raise public awareness. In some governmental forms, local ballot initiatives can be passed which take tax, appropriations and new programmes directly to the voter for approval.

3.4.ii Legislation

As noted above, legislation is not policy, and getting legislation passed then requires that implementation and enforcement also occur. There are many types of legislative efforts which can support urban agriculture; these are noted according to topical policy goals further below. However, general categories include the following:

Financial supports: these are actual budgetary-line items which a city, regional or national government or agency can approve to pay for specific activities necessary for urban agriculture. The breadth of activities can range from research to education, to market construction, to expanding existing programmes to better enforce existing laws. Most policy initiatives should be accompanied by financial support to pay for the proposed policy changes. Most legislative efforts will require a fiscal-impact statement which projects the costs of the proposed policy change.

Criminalisation/decriminalisation: these are changes in the penal code for activities related to urban agriculture. Examples might include giving increased penalties for destruction of crops and or other property in a community garden, or legalising the growing of vegetables in the front yard of privately-owned homes.

New programmes: the creation of new activities and divisions in existing agencies can be an effective way of getting more services for city farmers. Local government can mandate its agencies to provide or improve provision of services to farmers. It may be a simple change in language that includes farmers in a list of recipients of services from a given agency.

Zoning and other codes: seeking changes in zoning codes can open whole new areas of the city to new activities. They are often under the jurisdiction of local governments and agencies. Options include elimination of existing codes, new additions, reclassification of zoned activities and redrawing of geographical boundaries.

4. Enforcement

Ensuring enforcement of existing laws is a community watchdog effort. Knowing what laws are on the books requires legal research, but there may be beneficial laws on the books that are little known and completely forgotten or ignored. The Landless Movement in Brazil (MST) has used the existing land-reform laws to take fallow land from wealthy landowners (Langevin & Rosset 1997, Lappé et al. 1999). Enforcement of laws that contradict actual current policy or challenge powerful social sectors comes at a tremendous cost and requires strong community organisation, high levels of commitment to the issue and strong multisector alliances in order to achieve results.

Making sure that new laws and regulations are enforced requires clear definition of enforcement practices and working with enforcement agencies to ensure that the law is not interpreted differently. Enforcement policy may have to deal with a whole other set of constraints such as enforcement capacity, priority and other bureaucratic limitations, as well as graft and corruption.

Getting new laws enforced after achieving legislative and regulatory results may be harder than getting the laws on the books, if there has not been a real shift in political will. If the attitudes of government and enforcement agencies do not change but somehow the laws do, serious work lies ahead. Thus, policy initiatives must be structured to build constituencies as they go, so that – when critical moments arise –there are outspoken and important constituencies there to follow through.

4.1 Financial incentives

Financial incentives can take several forms. They can be cash incentives directly to farmers for complying with a set of criteria, such as not using contaminated water, or eliminating pesticide use. Tax breaks are another form of financial incentive. If a tax system already exists for producers and marketers, then tax incentives can be used in this arena. Giving retailers a tax break for buying from local producers is a good example. Tax breaks can also be given to other sectors for working in collaboration with farmers. Private corporations or other urban landowners may be given a tax break for allowing farmers to use their land. Fees for specific activities can be waived for participants in an incentive programme. Indirect financial incentives such as zoning variances or permits may be issued in public-private collaborations in exchange for providing resources to farmers. Preferential contracts and government-supported credit programmes for farmers can also be used.

4.2 Non-financial incentives

There are also a series of non-financial incentives can be used especially in public-private collaborations. Public recognition, media opportunities and other forms of legitimisation can be strong incentives for corporate sponsors. Corporations needing to improve public image with their stockholders and other groups have traditionally used social works as a means to achieve this.

4.3 Agency reform

Agency reform is not really a tool as such but rather a strategy to focus significant resources and attention on one particular agency. Successful reform not only changes the regulations, enforcement, and services; it also changes the attitude of the agency towards urban agriculture. For example, getting the Ministry of Public Health to see urban agriculture as a positive and important part of public health would dramatically change opportunities in most cities.

It is not so much obtaining the specific services, such as testing of irrigation water, but obtaining complete “buy-in” of the agency in its disease-prevention programmes, nutrition programmes, research efforts, community outreach, relations with other agencies, etc. In other situations, agencies may have farmers in cities loosely or indirectly under their mandate, and agency reform may be more an activity of making them recognise that they should be serving this community. Advocacy and constituency building in such situations can bring existing resources, programmes and/or reorientation of interventions for urban farmers.

5. Topical areas of policy action

5.1 Resource use

5.1.i Securing tenure

Land tenure is one of the most important and hardest resources for city farmers to acquire and secure. From Mexico City to Cairo, from New York to Dar es Salaam, getting and keeping access to land and title or some documented assurance of tenure is increasingly difficult in areas of ever-rising real estate values (Torres Lima et al. 2000, UNDP 1996, Biehler et al. 1999, Green Guerrillas 1999, City Farmer 1999). In many cities where men have traditionally been the holders of land titles, laws for women’s tenure are urgently needed.

Yet the backlash to uncontrolled urban sprawl is picking up. Working with planners to include agriculture as a part of greenbelts, city parks and open spaces can create mutually beneficial results, as farmers can gain access to land that is protected from future urban sprawl, and planners can justify the space as being productive. An active user population thus occupies the open space, ensuring on-site enforcement against unofficial settlement and added protection against future rezoning (Torres Lima et al. 2000, UNDP 1996, Yoveva et al. 2000, Biehler et al. 1999).

Working with public utilities and other national enterprises to gain access to rights of way and unused land may be possible. Public-private collaborations may present possibilities with the corporate sector. Many international businesses are given land concessions by State and local governments which may be requested for farming purposes. Tax breaks and other incentives can be provided by national and local governments. Organised farmers' groups, co-operatives and NGOs have successfully negotiated user permits or leases on both public and private land for specific activities and for specific periods of time (UNDP 1996, Garnett 2000, Nuru & Bloom 1996). Making a strong case for the multiple functions and benefits of small farms is a very good approach with open-space planners (Biehler et al. 1999, UNDP 1996, Rosset 1999).

Public housing projects are increasingly including garden space and can be approached to negotiate permits or leases. This has been demonstrated notably in the North in such cities as London, San Francisco and Seattle (Garnett 2000, Nuru & Bloom 1996, Friends of P-Patch 1999). In New York City, however, gardeners have been pitted against low-income housing groups in what has turned into a nasty political battle for more than 600 gardens which the City tried to auction off, supposedly to alleviate the housing crisis. This divide-and-conquer approach of the city government has backfired, as garden groups and housing groups have banded together to fight for real low-income housing solutions without elimination of the gardens. The Trust for Public Land put up 3 million dollars to purchase 62 of the most threatened gardens, and Bette Midler's New York Restoration project acquired the remaining gardens for 1.2 million dollars (Green Guerrillas 1999, City Farmer 1999).

In some countries, good laws exist on the books for land reform. Many countries established such laws at times when the international trend set by western aid agencies was to avoid land-based revolutions and social movements by developing agrarian bases attempting to make all agricultural land productive. They may have clauses which allow a squatter to make a claim on a piece of land owned either by the state or a private landowner if the land has been unproductive for a given amount of time. The Landless Movement in Brazil (MST) has used this type of law to settle over 150,000 landless families on more than 2.1 million hectares of land left idle by wealthy land owners (Lappé et al. 1998, Langevin & Rosset 1997). The MST is now working with urban squatters and using similar tactics in urban areas. They have been successful in their organised occupation strategies because of a combination of a strong legal foundation, legal support, extremely organised and committed groups, and strong relationships with other social movements.

Getting real reform laws on the books in the current context is extremely difficult. The World Bank as well as some of the regional development banks are promoting titling and digital upgrading of the cadastre in an attempt to resolve titling difficulties in many countries. Most of these efforts are designed to register titles in order to provide small farmers with collateral for production loans, and to split up communally held lands for similar reasons (Torres Lima et al. 2000). Regardless of these trends, there is little or no talk of urban land reform in these circles. However, improvements in procedures for registration and resolving ownership disputes may be a vehicle for better titling for those who have unregistered ownership.

In a very rare case for this decade, Cuba has implemented a new agrarian reform, which is distributing land to small farmers in urban areas. This programme is carried out through the collaboration of the *Poder Popular* (neighbourhood-level government) and the Urban Agriculture Office of the Ministry of Agriculture. These lands are given in usufruct ownership in perpetuity – as long as they are kept productive. Many other state-run enterprises have been giving farmers access to their lands in a sort of joint-venture arrangement called Farms of a New Type.

5.1.ii Access to water

After land, water is probably the second most important resource for urban agriculture. For many areas, year-round production would be possible if it were not for water limitations. Additionally, in many tropical areas, the best time for small-scale vegetable production is in the cool winter months, when there is usually little rain.

There are many ways to address this issue. In areas where potable-water systems exist, changing the rules about using water for agriculture can be a viable alternative. This debate often comes down to an issue of priorities and, when pushed to the wall, local water boards will often say that there is not enough water for everyone and that providing water for drinking and washing clothes is more important than providing water for producing food. It is critical to work with other members of the community who share the water system, educating them about the importance of food production for that area, and to show real benefits of irrigation for the rest of the community in terms of increased access to fresh foods.

In areas where little water is available, seeking financial resources to install cisterns, wells and/or irrigation systems is another route. In areas where neither of these options is possible, educating farmers or would-be farmers about reducing water needs through planting crops that need little water, heavy mulching, simple drip systems and rainwater-collection systems may be the only alternative.

Working for increased sewage treatment can provide urban agriculture with both fertiliser and water, but must be done carefully to avoid accumulation of heavy metals and biological contaminants. This topic is handled in the heath section below.

5.2 Technical support services

In these times of Enhanced Structural Adjustment Programmes (ESAPs), trade liberalisation and privatisation, the slashing of state budgets for services is being pushed throughout the globe (Bello 1998, Lappé et al. 1999, Mellor 1998). The impact of this on agriculture has been an increased reliance on contractors, corporations and NGOs for services to farmers, while national research and extension agencies are being reduced to seed and pesticide registration and testing, and some crop development (Conroy et al. 1996).

Corporations generally provide services only to contract farmers producing for the export market or those consuming considerable amounts of chemical inputs. This leaves the NGO sector for most subsistence farmers and small farmers producing for the local market. Increasingly, successful farmer organisations are hiring their own advisors who must respond directly to their needs.

Policy initiatives that seek to build technical extension services should promote a flexible approach that recognises the success of existing organisations and builds on those efforts rather than creating competing or duplicating efforts. New extension models based on a high degree of farmer participation in the pre-project analysis and development stages have been highly successful compared to traditional teach-and-visit models (Antholt 1998, Chambers 1983, Bunch 1985).

Even if extension services are provided through public agencies, it is often advantageous to require farmers to share costs or at least pay a nominal charge for extension services for several reasons. Most importantly, this gives increased rights to the farmer, as the service is no longer a gift but rather is paid. It removes some of the financial burden from government and reduces paternalistic relations between extension agents and farmers. Finally, it moves the accountability of a project back into the hands of the beneficiaries, making the results production- and demand-driven (Antholt 1998). Another model, further into the competitive market model, is to seek state funding for private extension services, where farmer organisations receive grants which they use to contract the extension services they need.

In spite of the global trend to cut state spending in these areas, there are countries providing extension services for city farmers. Case studies from Cuba, the Philippines, Tanzania, China and Mexico show that this is possible in some contexts (Companioni et al. 1999, Mougeot 1994, Murphy 1999, Potutan et al. 2000, Jacobi et. al. 2000, Torres Lima et al. 2000).

5.3 Input/output support services

All governments have policies that affect the commercial sector of urban agriculture. At a bare minimum, there are state controls over some aspects of pesticide sales and local markets for produce and meat. There are, however, many aspects of the input/output service sector which are generally not addressed.

5.3.i Farm implements and conventional inputs

Traditionally, national agricultural extension services tried to leverage state expenditures for staff time to obtain foreign-aid packages of seeds, fertiliser and pesticides. In some cities, this same model of rural extension has been replicated. Foreign companies traditionally used aid packages of this kind to introduce their chemical products to new markets.

In areas where small farmers were brought into the global economy through the expansion of the fresh fruit and vegetable industry and non-traditional export crop programmes, there are innumerable retail outlets selling these products in small quantities for small farmers. Technicians paid by the export contractor or the chemical companies work with contract farmers and are often paid based on commission from sales. For production for subsistence and local markets, however, the cost of these imported chemicals and seeds is often prohibitive. Additionally, the replication of Green Revolution off-the-shelf technological packages for small farmers has been shown to cause social disintegration and stratification, and increases farmers’ exposure to health and financial risks (Conroy et al. 1996, Thrupp 1995, Shiva 1993). Thus, there is a tremendous need for specialised and alternative products and services geared toward the small- and medium-scale subsistence and commercial urban farming sector.

5.3.ii Compost and other amendments, pest control products

As many urban farmers are working with very limited resources and very close to high-density populations, urban farms should be basing their production on organic or semi-organic methods and not using dangerous chemical pesticides (Companioni et al. 1999). This requires both qualitatively and quantitatively different sets of input services than for conventional farming practices.

Networks of small stores that provide the appropriate tools, seeds, soil amendments and pest controls can be created through government programmes, as they have been in Cuba (Companioni et al. 1999). These networks can be directly run by the state, or they can be created through incentive programmes working with existing or new store-owners. Incentives might include low-interest start-up credits, access to cheap or subsidised products, small business management training, exclusive contracts with state suppliers, etc. One of the biggest obstacles for such networks is creating an adequate supply of locally produced non-chemical inputs.

Co-ordinated efforts between municipal solid-waste managers and new entrepreneurial composters have emerged in some areas (Biehler et al. 1999, UNDP 1996). In areas of the USA where advanced recycling programmes exist, the cost of managing municipal waste is so high that local governments are paying private companies to compost the landscaping residues from city parks as well as providing home pick-up services for vegetative household wastes (not including kitchen waste). This reduces the volume of waste destined for landfills and thus reduces costs for the municipality. The company is then required to provide compost to both city agencies and urban farmers. The composters sell the rest to rural farmers and private landscaping companies.

In other areas, local animal farmers may give away their manure so they do not have to pay for waste removal. City projects providing transportation for the manure could eliminate illegal dumping and subsequent water contamination and, at the same time, provide farmers with organic fertilisers. In some cities, market demand for manure is so high that animal farmers sell their manure; this provides them with added income and pays for transportation.

Biological pest controls have been successfully used in urban environments and can be locally produced. Havana has several Centres for the Reproduction of Biological Controls (CREEs) and local farmers have access to both artisanally produced biological pest controls as well as products from national industrial-scale production (Altieri et al. 1999, Companioni et al. 1999, Murphy 1999).

Seed needs are very different for urban farmers. They need small amounts of a wide variety of cultivars adapted to the different urban environment and market demands. Open-pollinated seeds are preferred, as they can be saved and reproduced. Research and development programmes for urban varieties are important, and storage and well co-ordinated distribution projects can help to keep a viable stock of pre-packaged seed available. As space in urban gardens is often extremely limited, urban seedling production can be an area for expansion of small enterprises.

5.3.iii Markets

Active urban-farming economies and the food-security needs of urban populations demand a highly decentralised system of point-of-sale outlets for fresh foods. Markets for meat and produce are generally created and regulated by municipal governments and often with inspection from national health agencies. At the most basic level, creating more market spaces in more areas is an important starting-point. Many cities simply do not have enough outlets, or the outlets are concentrated in commercial districts. Changing point-of-sale and business licensing regulations can also increase on-site sales. Seeking increased funding for market construction and maintenance is the most obvious approach, but organised farmer groups may need only space and permits to begin markets in new communities. The Farmers' Market movement in the USA has taken off without the construction of new market places, by setting up mobile neighbourhood markets once a week in specific locations.

Tax incentives, price supports and fixed contracts with state distribution chains are other approaches. Farmer groups may work with local agencies to obtain fixed preferential contracts for school-lunch programmes, hospitals, cafeterias, and other programmes and enterprises. Farm-to-market and home-to-market transportation is another area which should be considered when improving the market system.

5.4 Health impacts

5.4.i Pesticides

In most countries, chemical pesticide use by small farmers is a serious health issue (Murray 1994, Potutan et al. 2000). Farmers often seek the most toxic pesticide at the lowest price to ensure effectiveness, and many countries still allow the use of very toxic and persistent substances. Protective measures are not regularly used by small farmers, and backpack sprayers have constant leaks. Transportation, storage and disposal are other high-risk issues. When small farmers apply pesticides in high-density urban environments, pesticides become an even bigger public-health issue.

Municipal ordinances preventing the urban sale and use of agrochemicals or heavy local taxation on urban pesticide sales can reduce pesticide use. Prohibiting urban use in farming requires a great deal of enforcement. If pesticide products are readily available in other areas, prohibition and taxation may only increase farmer production costs and create black-market sales which are less regulated and potentially more hazardous as they involve rebottling, sales without labels and unsafe transportation (such as on public buses). Eliminating key products from the national market may therefore be a better approach. Farmer incentives and education programmes are other approaches.

Cuba’s biological-control system based on small-scale, decentralised intermediate technology laboratories is a highly replicable model for governmental and NGO agencies attempting to find a real solution to the pesticide problem in cities. They are low cost yet highly profitable, and can eliminate dependence on dangerous, imported chemical inputs (Rosset 1998).

5.4.ii Lead and heavy metals

Lead in soils and in the air is a major contaminant that green leafy vegetables can concentrate in their leaves. In a recent case in Richmond, California, the children of a low-income Laotian family suffered serious learning and brain function disabilities caused by lead concentrations in the greens they harvested from their garden. This story, which was highly publicised in the USA, goes undocumented in most countries throughout the world.

In many other cases, lead and heavy metals have been reported as contaminants of soil, water and vegetables and can cause direct health impacts. Such reports can provoke consumer and policy-makers' distrust of all locally produced foods, regardless of actual contamination (Gertel & Samir 2000, Mbiba 2000, Torres Lima et al. 2000, Garnett 2000). Regular testing of all foods is a policy that can help ensure a safe food supply, and all foods unfit for human consumption should be destroyed.

Other options are to seek serious toxic-abatement programmes to solve the root of the problem. Efforts should be made to convince health agencies to include urban agriculture into existing programmes. Working to eliminate the release of lead, heavy metals and industrial toxins in poor communities is an uphill battle against industry. Many efforts in the Environmental Justice movement have had successes in increasing enforcement of existing environmental regulations and forcing industry to reduce emissions. Where these toxins are found in the soil, soil removal and replacement is the ideal solution, but raised beds with imported soil may be the only viable option.

In many cities, as solid waste disposal becomes a more complicated and costly issue, the use of municipal solid waste is being considered for composting and food production. Like sewage solids, these new waste products need to be thoroughly tested and, in many cases, may be inappropriate for use in agriculture. Batteries, paints, solvents and other toxins find their way into virtually all landfills at some level. Unless compostable waste is separated at the source rather than at the landfill, there is no way to extract "clean" materials.

5.4.iii Biological contamination

In some cities, farmers use drainage runoff and raw sewage to irrigate. While public health laws exist to prevent this practice, implementation is varied (Gertel & Samir 2000, Mbiba 2000). Sewage can be treated through pond systems that are relatively inexpensive and low in maintenance and that produce multiple benefits. These systems have long residency periods (>60 days); this eliminates faecal-borne pathogens, making the effluent free of biological contaminants. The system uses algae to consume excess nutrients and oxygenate the water. These algae can bio-accumulate heavy metals and other industrial wastes to the extent that, when it is removed, the effluent going to agriculture is free of these contaminants and the algae can be treated as a solid toxic waste rather than a liquid one. If there are no industrial toxins in the sewage, the algae can be used as animal feed or fertiliser.

Modern plants to treat industrial sewage are expensive to build, require much energy, have short residency periods (about 3 days – if something is not working properly, they pass pathogens right through), have many special moving parts and depend on chemicals. They also have massive sediment build-up, which is often dumped on rural agricultural land, contaminating it with heavy metals and other contaminants. Promoting pond facilities can solve multiple problems of health risks, waste disposal, and needs for fertiliser and water.

5.4.iv Disease prevention

Poorly managed animal production can cause risks to public health. Accumulation of faecal materials can provide breeding grounds for harmful pathogens as well as the insect vectors that carry them. Poorly managed compost piles can become hospices for flies, rats and other vermin. Finding policy initiatives that can both prevent such problems and promote urban animal husbandry and composting is not easy. Public health officials would rather eliminate the potential for problems than work to find a mutually beneficial solution. Increased public-education campaigns on food sanitation may better address the issue as, in some cases, a large portion of the foods are contaminated whether they come from urban or rural sources.

6. Conclusions

Urban agriculture is providing solutions to many of our cities' problems at the community level. It is increasing food security, while providing home-grown employment opportunities, environmental clean-up, beautification and offering recreational and educational activities for young and old. While some city and national governments have taken leadership in promoting urban agriculture through policy initiatives, most have not.

Without institutionalised support for their efforts, urban farmers in most cities will have to continue to struggle against existing regulations, agencies and financial disincentives. Advocating for policy change in those areas without sufficient support is worth the effort, for small changes in policy can mean big changes for farmers. Local governments need to awaken to the fact that, for relatively small investment in personnel, capital, and legislative and regulatory change, they can catalyse communities to help solve so many of their immediate needs. While international food policy and the transnational conglomerates that drive it continues to put the squeeze on lower- and middle-class urban populations, it is the responsibility of local government to provide at least a policy context in which people can create their own solutions.

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INSTITUTIONAL ASPECTS OF URBAN AGRICULTURE IN THE CITY OF DAR ES SALAAM

Michael Mwalukasa

1. Introduction

This paper analyses the mechanisms for institutionalising strategies of urban agriculture in the context of an East African city. The policy agenda needs to focus on managing urban land uses for improving production of food to sustain the growth of cities. The particular focus here is on the planning and management initiatives taking place in the city of Dar es Salaam. With an estimated population of almost 3.0 million and a growth rate of 8% per year, fuelled by rural-urban migration and natural increase, Dar es Salaam is one of the fastest-growing cities in sub-Saharan Africa.

The initiatives described permit different stakeholders to discuss their problems, to negotiate strategies and to seek collectively solutions to priority issues of common concern. It is based on enabling participation and building commitment. Several activities have taken place in strengthening the capacity of the city authority, namely:

- consultation in which rapid assessments are conducted, environmental issues are clarified, key actors are drawn in, political commitment is achieved, and priorities are set through an informed consultative process;
- formulation of an integrated strategy for urban management that embodies long-term goals and phased targets for meeting the goals; agreement on issue-oriented strategies (that cut across the concerns of various actors) and actor-specific action plans (that cut across various issues) for achieving the targets; identification of project options, policy reforms and institutional actions; and
- follow-up and consolidation, in which agreed programmes and projects are initiated/ implemented, policy reforms and institutional arrangements are solidified, the overall process is made routine, and monitoring and evaluation procedures are put in place.

Through this process, different stakeholders are brought together. Stakeholders include those who are affected by the problems, those who create the problems and those who have the institutional responsibilities, tools, instruments and resources to manage the problems.

2. Shortcomings in urban planning

In the past, the growth and development of Dar es Salaam has been guided by comprehensive plans known as Master Plans. These were prepared to cover a period of 20 years, indicating the anticipated growth direction of the city through land-use zoning with development standards.

The 1979 Master Plan provided the framework to manage the future growth and development of the city. However, implementation of the development policies, programmes and projects proposed in the plan was severely limited because:

- the plan was comprehensive in nature, proposing optimal but unaffordable infrastructure and social-service development and budgetary requirements;
- it was control oriented with rigid standards and conditions that could not be enforced in the context of the rapid urbanisation;
- implementation was limited by a sectoral approach to development;
- the plan was prepared by expatriates, with limited participation of nationals; this reduced local understanding and commitment to implement the proposals.

The 1979 Master Plan has not guided the growth and development of the city. There were no institutional mechanisms to co-ordinate the parties involved in managing growth or to encourage investments. The plan contained no representation from the interested parties in urban development, as there was no participatory mechanism to involve them in either plan preparation or its subsequent implementation. By 1990 the demands for water, good communications, serviced land, sanitary management of solid and liquid wastes remained unmet, resulting in deteriorating environmental conditions.

3. New initiatives: environmental planning and management approach

The Sustainable Cities Programme in Tanzania (SCP-TZ) builds capacity of municipal authorities to enable them plan, co-ordinate and manage their urban development through the application of the environmental planning and management (EPM) approach. Dar es Salaam City was one of eight cities in Africa to adopt and apply the EPM process in urban planning.

The process is being carried out by the Sustainable Dar es Salaam Project (SDP), which was launched in 1992 and became fully operational in November 1993. Its overall aim is to strengthen the capacity of the city authority (then the Dar es Salaam

City Council) to plan and manage the growth and development of the city in partnership with interested groups of stakeholders, including public, private and civil-society organisations.

This approach focuses on the environment-development interaction and is both bottom-up and stakeholder-driven. Through stakeholders' consultation, critical issues are identified and prioritised. Issue-specific stakeholder working groups are then formed around these issues to prepare strategies and action plans. The municipal authorities, together with the stakeholders, then implement the action plans.

The project contributes to sustainable development of the city region by:
- strengthening the local capacity of the partners to jointly plan, co-ordinate and manage environmental and development activities;
- preparing a long-term strategic and integrated investment and urban development plan through policy formulation and policy implementation.

The project sets out to achieve this by adopting a four-stage approach: preparation of a city environmental profile; holding a city consultation on environmental issues; establishing an institutional framework (working groups) to prepare preliminary development strategies and detailed action plans; and preparation of a strategic urban-development plan for Dar es Salaam.

The city consultation in 1992 identified nine environmental issues that were to be addressed by SDP. Urban agriculture (UA) was one of the major environmental issues. After the main consultation, "issue-specific mini-consultations" were conducted between 1993 and 1995, involving key stakeholders who represented public, private and civil society organisations. The objectives included: prioritising the most pressing problems; agreeing on environmental strategies of action; agreeing on immediate and short-term actions for the representative institutions; and formulating, mobilising and establishing cross-sectoral and multi-institutional working groups to prepare detailed spatial, financial and institutional action plans for each strategy component.

4. Urban agriculture and the Urban Agriculture Working Group

A working group within SDP was formed to deal with the development and management of UA in relation to recreational areas, open spaces, hazardous areas and greenbelts.

The working group adopted the following definition: *UA refers to carrying out farming activities in built-up areas where open space is available, as well as keeping livestock (dairy cattle, goats, sheep, pigs and fowl) in built-up and in periurban areas*. In the Town and Country Planning Ordinance (CAP 378), (Urban farming) Regulations 1992, "urban farming" means carrying out of plant and animal husbandry activities within statutory township boundaries as provided in schedule 3-1[1]. Two examples taken from these regulations state: (i) no person shall occupy or use more than three acres of land for urban farming; and (ii) no person shall, except where that person practices zero-grazing, graze his animal in an urban area" (Government Notice No. 10, of 5/2/93, p.10).

For a more detailed account of the nature of UA currently practised in Dar es Salaam, the reader is referred to the city case study (Jacobi et al. 2000)

This working group comprised representatives from various stakeholder groups:

- segments of the urban dwellers (the urban poor, men, youth groups and women groups);
- village governments (especially in the periurban areas);
- various government ministries: Ministry of Agriculture and Co-operatives; Ministry of Lands, Housing and Urban Development; Ministry of Natural Resources, Tourism and Environment; Ministry of Water, Energy and Minerals;
- financial institutions;
- the Dar es Salaam City Council (now Dar es Salaam City Commission);
- the National Environmental Council;
- business groups: Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA); charcoal makers and retailers; wood-building materials cutters and retailers; firewood cutters and dealers;
- informal businesses, e.g. petty trading - street hawking, street food vending, market operators;
- civil society groups, non-governmental organisations (NGOs) and community-based organisations (CBOs) within the city and in the urban villages.
- Dar es Salaam City Council;
- National Urban Water Authority;

- Ministry of Agriculture and Co-operative Development;
- financing institutions;
- industries that produce wastes (solid and liquid);
- urban farmers (in view of their activities vis-a-vis legislation, land-tenure issues, availability and non-availability of land for UA);
- urban dwellers, particularly those who inhabit hazard areas in valleys and floodplains; and
- livestock owners/keepers (bylaws restrict the number of animals that can be reared for reasons of hygiene, environmental hazards, social nuisance and accidents).

4.1 Urban agriculture structural and policy problems

In spite of the potential role of UA, it is characterised by various structural and policy problems that have so far constrained its contribution in the urban economy, the environment and human health. The Urban Agriculture Working Group has concerned itself with the broad policy and structural issues that constrain UA. Some of the key issues are:

4.1.i Insufficient consideration by relevant departments
The Ministry of Agriculture and Co-operatives recognises the importance of UA and provides extension services, though not as effectively and intensively as in rural areas. Being a relatively new area of intervention, UA requires greater consideration and needs more financial and planning attention from the Ministry.

4.1.ii Neglect of small urban livestock keepers and crop growers
In the Ministry of Agriculture and Co-operatives, there is a unit on horticulture, but few of the activities are linked with urban livestock and crop production systems, processing and marketing, or extension services for urban small farmers.

4.1.iii Failure by relevant authorities to designate and allocate land for UA
As urban areas expand, agricultural land is lost to other uses. This uncontrolled development is constraining the establishment of a greenbelt around the city, as envisioned by the city planners (for example, rapid expansion along the Bagamoyo road and west towards Goba, and also new settlements like SalaSala).

4.1.iv Land tenure issues
In the periurban areas, people buy land on a customary tenure without due regard to other planned land uses that might be necessary in the future. This is compounded

by the trend of people occupying land with potential for agriculture and using it for residential development.

4.1.v Conflicts between different land uses and urban agriculture over water

Apart from experiencing water shortages on account of drought, a major conflict exists between Dar es Salaam Water & Sewerage Authority (DAWASA) and those carrying out agricultural activities. This is mainly due to the high tariffs charged by DAWASA while large amounts of water are needed for cultivation.

4.2 Key aspects of the new strategy

In order to remove the constraints discussed above, the Working Group on Urban Agriculture developed a mixed land-use strategy that comprises various elements to be supported by developing instruments to encourage uptake of inputs and techniques that promote UA. The strategy has the following elements:

- restructuring land-access and land-use laws. The city council or the Ministry of Lands, Housing and Urban Development should make sure that the urban poor gain access to land on the fringe of the city for housing and farming, and they should abolish the bylaws that prohibit owning more than 3 acres of land for farming;
- using new UA techniques to use land more intensively (in small and marginal areas) as opposed to large tracts of land in the periurban fringe. This means trying out hydroponic farming, encouraging container farming (farming using limited soil media); and training farmers to make more use of the vertical growth of plants (trellising);
- incorporating non-food production, for example, floriculture (by encouraging the youth and other people to grow flowers in pots and on roadsides for sale), and arboriculture (tree planting on roadsides, in homes and in watersheds);
- moving large livestock to periurban areas and promoting growing of fodder on periurban farms; composting of organic waste collected in the city centre and transporting it to periurban areas, and generating biogas in areas where composting is taking place;
- reclaiming land that has been left derelict after quarrying/mining (e.g. Kunduchi quarrying/mining sites near SalaSala) for use by urban farmers;
- encouraging people to use more underground water from wells and boreholes, using hand pumps and electricity, where possible;
- using urban biodegradable wastes from market centres and homes for composting to grow mushrooms; and

- developing aquaculture in coastal lagoons and other appropriate inland areas and in tanks.

A mixed land-use strategy for the city that would incorporate the demand for agricultural activities has several specific components:

- maintaining green spaces with flowers and ornamental trees to beautify the city;
- avoiding subdivision of areas by overbuilding, and keeping open spaces under some form of agriculture;
- maintaining trees to break wind and to reduce air pollution, especially by gaseous fumes and dust;
- encouraging livestock keeping and crop growing in low-density residential areas where this is already a common practice, provided stipulated bylaws are followed;
- supporting vegetable growing and small livestock keeping in high-density areas where open space is available and small-scale farming is common practice;
- where new plots are surveyed and allocated, especially in the periurban areas, bigger plots of at least 3-4 acres should be allocated for residential purposes to those who intend to carry out urban farming (crop growing and livestock keeping). Such large areas would allow space for fodder production, disposal of manure or construction of composting systems (and thereby produce manure and biogas);
- no livestock rearing in high-density residential areas;
- zero-grazing in built-up low-density residential areas; and
- open grazing only in periurban areas.

4.3 Instruments to enhance the urban agriculture strategy

One example of the kind of measures proposed by the Working Group to promote UA development through a strategy of mixed land use is a project to rehabilitate the city's existing horticultural gardens. This is discussed briefly below before considering other types of supporting instruments under the UA strategy.

In the 1970s, the Dar es Salaam regional authorities established horticultural gardens to provide food security, create jobs and alleviate poverty. The project for urban horticultural garden development selected former gardens and added new ones. These form the principal demonstration and production areas. Impacts are expected to spread to all parts of Dar es Salaam city region.

The strategy of rehabilitating the city horticultural gardens will benefit many who work in the informal sector. In the periurban horticultural gardens in areas such as Malolo, Gezaulole, Kinyamwezi and Ukiviuta, youth groups will be supported in farming activities. Other interested people will also be supported. Tree nurseries are being prepared and will be planted by residents on their homesteads to combat soil erosion and conserve water catchment areas. Production of citrus fruit, vegetables and flowers as well as processing and marketing will be emphasised. Planting of trees to contribute to production of charcoal and construction materials will be encouraged.

The overall objective is to increase production of fruit and vegetables to meet the city demand and to improve the economic and nutritional status of the residents. The project has five target stakeholder groups: individual growers, community-based organisations (CBOs), non-governmental organisations (NGOs), the private sector and the City Council. In a group approach, five pilot gardens are being used for production purposes.

In order to stimulate the interest of farmers in the rehabilitation exercise, and to make use of the products and replicate the process in other residential areas, NIGP/DCC are availing funds for carrying out the rehabilitation. A credit scheme will be made available to committed growers and will be administered by a financial institution identified by NIGP.

In order to implement action plans intended to establish planned, regulated and sustainable urban horticultural development, a local project management structure is in place. The five pilot projects are maintaining five different accounts, each to establish a revolving fund so that revenues can be ploughed back to their gardens. An efficient marketing system is lacking at the present but is being explored. Serious rehabilitation has started to take place on the five designated gardens.

4.4 Other instruments to enhance the urban agriculture strategy

4.4.i Information campaigns

- The mass media play an important role in educating operators and decision-makers on the significance of UA. Television and newspapers can produce articles on urban farming, research and environmental issues. Newspapers can warn residents against keeping animals in the urban areas contrary to the laws;
- workshops and seminars help to disseminate information on UA and strategies for poverty alleviation, income generation and planning issues in general; and
- booklets and leaflets on urban farming or horticulture development, on methods

of controlling pests and insects through intermediate or adaptive technology, e.g. integrated pest management (IPM), and on water harvesting can be employed.

4.4.ii Economic incentives

- Provision of insurance from the National Insurance Company to cover livestock investments is a great incentive to urban livestock keepers;
- provision of extension services and ensuring availability of feeds and veterinary drugs;
- charging reasonable tariffs for use of treated water in irrigated agriculture as well as making small-scale credit available to small-scale UA producers; and
- encouraging owners of land (especially public institutions) to put such land under UA temporarily.

4.4.iii Provision of finance for long-term investments

- Supporting possibilities of obtaining NIC coverage where large numbers of livestock or poultry are being produced;
- promoting large-scale production and processing of dairy products in the periurban areas to supply key institutions like schools and the army;
- encouraging investments in market gardening and commercial floriculture;
- encouraging investments in major supply units for gardens and farms, e.g. installation of water pipes, tanks and pumps to tap underground water; and
- construction of systems to harness and store rainwater.

4.4.iv Regulations

- The City Council / City Commission must enforce existing bylaws (e.g. prohibition on rearing more than four head of cattle in urbanised areas); people wishing to keep more than four head should be helped to move to periurban areas;
- the City Council / City Commission in collaboration with the Ministry of Lands, Housing and Urban Development should allow residents with plots in the periurban areas or low-density areas to practise UA provided the areas do not exceed 3 acres as stipulated in the bylaw on urban farming of 1992;
- issue “stop” orders to prohibit building on hazardous floodplains, especially in the Msimbazi Valley;
- farming in prime water-catchment areas should be restricted in order to protect sources of surface water;

enforce bylaws to protect road reserves from haphazard building and squatting, yet allow roadside UA to operate, because it preserves road reserves, is easy to modify and compensation is minimal since UA activities in such areas are temporary or transient;

- ensure secure land tenure by allocating land to UA practitioners, and allocate relatively big plots in periurban areas for people intending to carry out mixed land uses including agriculture;
- regulate water tariffs to ensure fair rates for UA operators;
- free grazing should be restricted to periurban areas, while zero-gazing is to be encouraged; and
- UA on house plots in open urban areas can continue, but residents must keep the environs clean and recycle as much household waste as possible.

4.4.v Increasing co-ordination

- Ministries that share much in common with regard to UA (Ministries of Lands, Natural Resources and Tourism, Water and Minerals, Agriculture and Co-operatives) need to exchange expertise to be able to promote UA strategically;
- working groups must involve CBOs, NGOs and small- and large-scale farmers in prioritising needs and developing strategies to improve UA and to minimise environmental problems; and
- since the city is expanding quickly along the major road arteries, efforts must be made to co-ordinate with developers and road-construction companies to allow enough space for road reserves, installation of utilities, planting trees and flowers, and growing fruit and vegetables.

4.5 Institutional implications of implementing the urban agriculture strategy

In the past, the general public lacked proper understanding of planning and implementation processes and of central and local government policies in the city. Public awareness was low, and so was public participation in policy formulation and implementation.

An approach is said to be institutionalised when it is understood, widely accepted and routinely applied in decision-making in city management and planning. The establishment of the planning and co-ordination department within the city has enhanced the strength of system-wide capacities for planning and management. It has improved cross-sectoral and interorganisational co-ordination. It has created an effective system to monitor and evaluate.

Effective adaptation of the planning and management process calls for new institutional relationships and compatible political and social norms. For example, managing the cultivated areas in the flood-prone areas of the city should involve co-ordination between the Ministries (Agriculture, Lands, Natural Resources), city departments, environmental council, NGOs, CBOs and the cultivators themselves.

The institutional aspects discussed in this paper indicate clearly where future emphasis needs to be placed by the city authorities if UA is to prosper. The consistent application and promotion of the approach described here will support improvements in information and expertise, in decision-making, in implementation and in efficient resource use. During the city consultation, a mechanism for prioritising issues and building consensus was established. This consensus is being practically addressed now through cross-sectoral working groups.

1 Stipulated schedule: (i) Cultivation of crops including horticulture (garden cultivation), viticulture (grape growing), floriculture (cultivating flowers), plant stirpiculture (breeding of special stocks, strains), including medicinal and cosmetic herbs; (ii) Rearing of animals including cattle, goats, sheep, pigs, poultry, rabbits, horses, and animal stirpiculture; (iii) Urban forestry, including arboriculture (cultivation of trees or shrubs), silviculture (tree growing), apiculture (bee-keeping), and sericulture; (iv) Wildlife keeping including zoos, zoological gardens, etc.; (v) Aquaculture (cultivation of crops or rearing of animals in water); (vi) Serpentaria, including snakes and crocodile farms; (vii) Farm homesteads: the carrying out of any activities in (i) to (vii) in association with residential accommodation.

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THE INTEGRATION OF AGRICULTURE IN URBAN POLICIES

Henk de Zeeuw, Sabine Guendel and Hermann Waibel

1. Introduction

This chapter summarises the discussions and conclusions of the working groups and plenary sessions which took place during the International Workshop on urban agriculture "Growing Cities, Growing Food – Urban Agriculture on the Policy Agenda", Havana, Cuba, October 1999. In addition, the thematic papers and case studies presented in earlier sections of this reader are reflected upon in this summary.

This chapter will describe a range of policy options identified by the participants as suitable for enhancing the contributions of urban agriculture to urban food security, urban economy and city ecology.

2. Present conditions of urban agriculture

Participants consider urban agriculture as a dynamic concept that comprises a variety of farming systems, ranging from subsistence production and processing at household level to fully commercialised agriculture. Urban agriculture normally has a niche function in terms of time (transitory), space (interstitial) as well as specific social (e.g. women and low income groups) and economic (e.g. financial crisis, food shortage) conditions.

It has been observed that urban agriculture exists within heterogeneous resource utilisation situations, e.g. under conditions of scarce as well as abundant land and/or water resources. In terms of its contributions to development, urban agriculture enhances food security, provides additional income and employment for poor and middle-income urban dwellers, and contributes to an ecologically sound urban environment.

Urban agriculture exists under a range of policy environments that may be prohibitive or supportive to its existence and development. Contrary to the views of urban planners and many development experts, workshop participants concluded that urban agriculture has to be seen as a permanent component of the urban system. Although some forms of urban agriculture are based on temporal use of vacant lands, urban agriculture as such is a permanent feature of many cities in developing and in developed countries and is thus an important component for sustainable city development.

Urban agriculture can have different purposes: subsistence / food security; city ecology improvement; and income and employment generation. These purposes are by no means mutually exclusive and co-exist in a range of different combinations. For instance, poor families might be engaged in urban agriculture for several reasons. Whereas the woman may emphasise the importance of urban agriculture for subsistence, her husband might stress the additional income generating benefits of it. Meanwhile, urban planners may evaluate these activities on the basis of their contribution to urban greening and microclimate development or to the re-use of urban organic wastes.

Local forms of urban agriculture are diverse and vary in accordance with the purpose pursued by farmers engaged in urban agriculture, as well as with the different livelihood and resource circumstances. The diversity of urban agriculture is one of the main attributes which contributes to its importance within a wide range of urban situations and for a diverse range of stakeholders.

Subsistence/ food security
Many of the case studies point out that urban agriculture can make an important contribution in helping the urban poor to become food secure. However, there are a number of constraints which prevent urban agriculture from fully achieving this purpose. Urban agriculture for subsistence is - to a large extent - carried out on land that is not owned by the user: roadsides, riverbanks, along railroads, vacant private lands, parks, etc. The use of such areas is, in principle, transitional, and user rights are minimal. However, various systems of informal rent, lease and inheritance exist. Fear of eviction leads people to plant short-duration seasonal crops and prevents them from making investments to improve soil quality, introduce tree and shrub components, and undertake erosion prevention and water-harvesting measures.

A growing number of newcomers to urban agriculture cannot gain access to a sufficient amount of suitable land to produce the subsistence needs of the households. Although land is often available: they either take over long-farmed plots from relatives, take up smaller plots on more distant or lower-quality land, or else hire prized plots held by mid or upper-class urban farmers (see Drakakis-Smith et al. 1995, on Harare, and del Rosario 1999, on Santiago, Dominican Republic). Meanwhile, studies indicate that in most cities in developing countries large amounts of public and private land are vacant or under-utilised, even in the inner city areas (see among others Ning Purnomohadi 2000, Jacobi et al. 2000).

The issue related to food security is more a matter of inadequate access to resources rather than just the availability of certain food products. Food security in an urban context must be looked upon in the context of food crises (which can be temporal or more chronical) and at different levels (community, household, individual). Food insecurity is not only related to the amound of food available but also the question of food quality must be taken into account (see thematic paper of Armar-Klemesu, Nugent and Bourque 2000).

It has been observed that in several cases immediate and initial short term focussed interventions responding to responses to food crises due to political unrest, wars or environmental or economic crises, have been translated into longer-term policy measures and support services.

Conditions under which urban agriculture emerges as a strategy to overcome food insecurity were identified as follows:
- a perceived and articulated need for improved food quality or increased food quantity that induces the affected stakeholders to search for suitable alternatives
- the availability of and access to resources such as land (or other spaces, e.g. rooftops for cultivation), water, labour and inputs. The resource situation in turn influences the type of urban agriculture developed.

City ecology
The importance of urban agriculture for city ecology has been pointed out by Deelstra & Girardet (2000). Urban agriculture is a major component in creating a green city environment. Other contributions of urban agriculture in this context include the potential of urban agriculture for recycling and re-use of urban organic wastes and waste water, reduction of energy use by provision of fresh food close to the consumers and reduction of the ecological footprint of a city[1].

1 the ecological footprint of a city is a concept that the relates to the area required to produce food and energy for its inhabitants and to manage the waste produced by the city

Participants agreed that urban agriculture for city ecology has to be integrated into a wider concept of sustainability, which includes economic and social aspects. Increased awareness of a wide range of stakeholders is required to adequately support the concept of urban agriculture for sustainable city development.

Income and employment generation

Although income generation may be an important motivation for subsistence farmers, it becomes the main purpose in the commercial scale urban and periurban farms. Commercial scale farming is mainly found in the periurban areas, dedicated to intensive crop production, or specialised livestock production and small and medium size enterprises involved in the processing of agricultural products.

Important conditions for urban agriculture with commercial purposes include an institutional and policy environment of formal acceptance or at least tolerance and the provision of marketing facilities. Labour and access to services, such as technical advice and input supply, are usually available for the commercial farmers.

3. Outline of a policy framework for urban agriculture

The synthesis of different conditions, characteristics and purposes of urban agriculture, which we have developed in the previous section, indicates the importance of a careful analysis of the specific context before designing and advocating policy measures for urban agriculture. The diverse range of situations, which are clearly illustrated in the case studies and in the thematic papers, call for carefully designed specific policy interventions. These interventions must be linked with specific development objectives, to which urban agriculture is expected to make a significant contribution. As with other public policy interventions, it is particularly important that the impact of these policies on different livelihood groups are taken into.

In this section a range of potential policy options will be presented, which were identified by the participants as (potential) suitable policy responses to urban agriculture. It is clear that such recommendations are of a general nature and will have to be refined according to specific local conditions.

The following general policy issues as related to the three main purposes of urban agriculture are:

- to facilitate the improvement of subsistence oriented urban agriculture with the main objective of achieving *food security of the urban poor*, the main policy issues are: access of the urban poor to public and private land and water and enhanced security in land tenure (e.g. usufruct medium-term arrangements in the form of leasing schemes), human capacity building, development of farmer networks and organisations, gender sensitive approaches;
- to enhance the positive effects of urban agriculture on the improvement of the *urban environment*, important policy issues are: decentralised recycling of organic solid wastes and waste water, integration of urban agriculture in urban zoning and city development plans, enhancement of direct producer-consumer linkages (farmer markets, box schemes, community based agriculture, ...);
- to improve the *economic efficiency of* commercially oriented urban agriculture the following main policy issues were identified: the productive use of recycled organic waste and water, access to factor and product markets, participation of stakeholders in urban land use planning and improved access to public and private land.

In the following paragraphs, policy instruments are described in relation to the integration of urban agriculture in the following policy areas: **urban land use policy; urban food security and health policy; and environmental policy. In addition, a few remarks will be made regarding urban agriculture as a tool in social development policy.**

3.1 Integration of urban agriculture in the urban land use policy

Access to land and water resources, as well as security of user rights and the level of the land rent, are crucial factors in the development of urban farming. Access to prime locations is fiercely disputed. As described above, especially subsistence type urban agriculture often takes place on lands where property rights are in dispute. In planning land use in city development, more often than not, land allocation for urban food producers is excluded from land use plans. The policy instruments identified by the participants to achieve the objective of integrating urban agriculture in land use planning fall in the following categories.

Removal of unsubstantiated legal restrictions
The first step that needs to be taken is to persuade urban planners to accept urban agriculture as a legitimate form of urban land use. Participants strongly felt that a review of existing policies and bylaws is necessary as a precondition for the

removal of unsubstantiated legal restrictions on urban agriculture. Such a review should go hand in hand with the development of a number of measures to prevent encroachment on biologically sensitive areas, the use of drinking water for irrigation, or contamination of groundwater by high-external-input agriculture.

Recognition of agriculture as a legitimate form of urban land use could be measured by indicators, such as the inclusion of urban agriculture activities in official statistics, in urban land use surveys and in the city land use data base. Instead of formal ownership or permanent user rights, urban farmers could be supplied with short- or medium-term occupancy licences, which would give them some protection against coercion and would improve the chances of obtaining access to extension and credit services.

> Example: Dar es Salaam has one of the most elaborate bodies of legislation on urban agriculture in Africa, and multi-stakeholder surveys and workshops have been organised to suggest priority improvements to both text and enforcement (Sawio 1998).

Integration of agriculture in urban development planning

A further means to improve access to land is the integration of agriculture in urban development planning. This can be achieved by the following measures:

- *the revision of actual urban zoning bylaws and the integration of urban agriculture in zonification plans* indicating in which zones urban agriculture is allowed, and other zones where certain types of farming will be prohibited due to special conditions (for instance pig production in a catchment area for drinking water; prohibition of large scale poultry or swine farms in central locations of cities). Periurban agricultural zones can be included in city development plans as part of "green belts or green corridors" in order to avoid uncontrolled development and destruction of soil. Buffer zones can be created and inner-city areas can be reserved by giving these areas to community groups, farmer co-operatives and/or unemployed people on a medium term lease for gardening and other agricultural purposes (purposive specific leaseholds). Such periurban and inner-city green belts could be given a community title to ensure that such open spaces remain in the public domain and under community control;

> Examples: Colonial zoning bylaws have been revised to allow for specific production systems in specific zones in Kampala and Kumasi (Atukunda 1998; Abutiate 1995). Agriculture has been incorporated into urban expansion plans for Kinshasa, Dar es Salaam, Dakar, Bissau and Maputo (Mougeot 2000). Havana has exploited flexible zoning modalities (Cruz 1999).
> Green belts, including agriculture, are being created around Ho Chi Minh City in Vietnam and Shanghai in China (Pham Thuyet, Ngo Quang Vinh, Pham Van Bien 1999, Cai Yizong, Zangh Zanghen 2000).
> Pretoria, South Africa, has incorporated urban agriculture into the management of its urban open spaces and set aside land for urban agriculture in designated sectors of the city.

- *promotion of urban agriculture as a temporal use of vacant public and private lands*. An inventory of open spaces in cities will indicate where possibilities exist to permit urban agriculture as a temporal use of vacant public and of private lands. Local government may lease vacant land/ or derelict urban areas to neighbourhood groups or local micro enterprises for gardening and food production. They may also stimulate schools, hospitals and other private and public enterprises to do the same. Such measures, aside from creating more green areas in cities, may also help to prevent crime and the spread of diseases;

> Examples: In the early 1980s, president Shagari of Nigeria gave permission that all vacant public lands within urban areas could be used for cultivation without charge. Cuba has been actively promoting the use of open unused urban spaces for agriculture. Organised groups have been assigned undeveloped public arable land for fixed periods of time in the cities of Harare and Gweru in Zimbabwe.
> The governor of Jakarta issued a decree on the use of vacant land to mitigate the fallout of the Asian crisis for the laid off workers (Ning Purnomohadi 2000)
> Examples of tenure agreements between urban producers and owners of private or semi-public estates with idle areas can be found in Lima (hospital grounds), Harare (golf club), Santiago de Chile (school yards), Dar es Salaam (university campus), and Port-au-Prince (church grounds) (Mougeot 2000).

- *promotion of multifunctional land use and encouragement of community participation in the management of urban open spaces*. Under certain conditions food production may be combined with other urban functions such as recreation, water storage, nature conservation, firebreak zones and zones with high earthquake or flooding risk. Farmers may be encouraged (economic incentives, education) to participate in the management of such areas, which may reduce the public costs of managing these areas and will protect these areas against unofficial uses and informal re-zoning;

Examples: for an overview of cases see the recent e-conference on this subject by FAO/Netherlands.

- *the inclusion of space for individual or community gardens in new public housing projects and private building schemes.* New housing development should plan for communal space for agricultural activities. In the case of the planned conversion of agricultural areas for other land uses, the urban farmers could be supplied with alternative lands (land swaps).

Example: Dar es Salaam has included urban agriculture as interim or permanent land use in public housing schemes (Mwalukasa 2000, Jacobi et al. 2000).

3.2 Integration of urban agriculture in urban food security and health policy

Analyses of current trends regarding urban food systems reveal that, in order to achieve food security for the urban poor, a sole reliance on food produced in rural areas is insufficient. It is necessary for cities to develop plans to enhance urban and periurban food production, and to diversify away from the present reliance on the highly capitalised and energy-consuming "supermarket" model, based on the external supply of foodstuffs (Dahlberg 1998). For example, in East Jakarta some 18% of total food consumption in low-income households was produced within the city proper. This was even found to be 60% in Kampala, and 50% in Nairobi (Maxwell 1995).

Studies summarised by Smit et al. (1996) indicate that nutritional self-reliance, in the sense of an urban area producing half or more of its nutritional requirements, is possible in all but the harshest climates, after taking land and water needs into consideration.

One of the drawbacks of urban agriculture is its potentially negative health effects. For example, cultivated areas in cities may attract rodents and flies or provide breeding grounds for them, and thus contribute to the spread of diseases (e.g. Lyme, tick-borne diseases). Certain diseases can also be transmitted to humans by livestock kept in close proximity to them, if proper precautions are not taken (zoonosis, ryptosporidium parasites). Inadequate handling of agrochemicals and urban wastes may lead to health problems among urban farmers.

City authorities will have to develop and implement policies that minimise health risks without compromising the food security needs of the urban poor and recognise the existence of urban agriculture as more than just a temporary crisis phenomena.

Based on examples in many cities around the world, participants proposed the following measures to ensure safe agricultural production in urban areas.

Improved access of urban farmers to agricultural research, technical assistance and credit services

Overwhelmingly, access of urban farmers to agricultural extension services in most cities is very restricted. If it exists at all, it is directed at full-time commercial farmers mainly producing in periurban areas. Consequently, urban farming is often technically inefficient and ignores the potential human and environmental risks to a larger degree than in rural areas.

Recommendations on the design and implementation of extension services for urban agriculture include the following:

- the preparation of broader urban agriculture programmes (participatory problem analysis, developing institutional linkages and initial commitments, participatory project formulation, obtaining funding support of national government and/or international sources);
- dtimulation of participatory field research, oriented at development of technologies suitable for farming in confined spaces and with low risks for health and urban environment (ecological practices, space-intensive and water-saving technologies, health risk reducing practices, …); Organisation of farmers study clubs that actively engage in the technology development and assessment process;
- provision of training and technical advice to urban farmers, with a strong emphasis on ecological farming practices; ensuring provision of veterinary services; promotion of cost-sharing systems;
- improvement of access of urban farmers (with an emphasis on women producers and the resource poor) to credit schemes for productive investments in farm infrastructure by revision of loan conditions and/or establishing micro-credit schemes for urban farmers.

<u>Examples</u>: In Bissau, where municipal urban regulations do not oppose urban agriculture (except roaming cattle), the federal government with UNDP initiated a Green Belt Project which in the early 1990s benefited over 2000 cultivators, mostly women, in 14 urban districts (David & Moustier 1993).
In Dar es Salaam, the Urban Vegetable Promotion Project (Ministry of Agriculture and Co-operatives and GTZ) is strengthening urban producers' self help capacity as well as the capacity of the governmental extension structure to deliver services to urban farmers (technical advice, organisational support, access to loans and investment in infrastructure) (Jacobi et al. Kiango 2000).
In Vientiane City the Periurban Vegetable project (Hat Dokkeo Agricultural Station with EU) is assisting the urban vegetable growers (Bhounkhong et al.1999).

Improved systems for input supply and product distribution

Local governments may facilitate the local marketing of fresh urban grown food, by:

- organising forums to discuss marketing and post-harvest problems with urban farmers and identify potential solutions;
- authorising farmer markets, food-box schemes, consumer supported agriculture (CSA) and other forms of direct selling of fresh agricultural produce from urban and periurban producers to local consumers (under conditions of safe-food handling requirements and control of product quality) and promotion of the development of infrastructure for communal and direct marketing of urban and periurban produced food.

Promotion of the supply of natural fertilisers, bio-pesticides, soil amendments and quality seeds to urban farmers, can be done by:

- providing incentives (e.g. tax reduction) for enterprises that produce ecological friendly inputs.
- facilitating the creation of a network of local stores (private or co-operative) and /or the transport of organic materials and manure from the source to crop farmers.

Promotion of small scale enterprises linked with urban agriculture, i.e., input suppliers (compost production, plant nurseries, vermiculture, local seed production, fodder distribution) and enterprises for processing and marketing of locally produced food (processing, packaging, street vending, local markets, transport) can be done by:

- provision of start-up licences to starting micro-entrepreneurs;
- provision of technical and management assistance to small enterprises;

- support to the creation of local infrastructure for small scale food preservation and storage facilities (i.e., canning, bottling, pickling, drying, smoking).

> Examples: In Ghana, the Ministry of Food and Agriculture has introduced periurban milk collection to encourage periurban dairying in the Accra-Tema municipality (NRI, 1995). Brasilia D.F. is furthering the integration of small scale food production with local food processing and marketing (de Carvalho 1999).

Creating awareness of health risks through urban agriculture
Health risks associated with urban farming can be reduced substantially if farmers are well aware of these risks and know how to prevent them.
The following measures can be taken:

- education of farmers on the proper choice of crops (in relation to degree of soil and water contamination and distance to roads and industry);
- periodic testing of soil and water quality in the urban production areas; definition of norms regarding types of crops that are allowed on soils with specified levels of contamination (especially heavy metals); prohibition of all food production in severely polluted areas;
- define zoning restrictions for certain types of crops, e.g. no leafy vegetables near main roads;
- introduce crop production in containers using substrates;
- require proper handling of the products (e.g. washing or scraping of products in areas with air pollution) and secure hygienic conditions for local food processing and street food vending;
- require proper siting of animal housing and adoption of hygienic and veterinary measures through provision of monitoring and vaccination services.

> Examples: In Bulgaria the agricultural extension service has mobile units to execute on the spot tests on levels of contamination of agricultural produce (Yoveva et al. 2000).

3.3 Integration of urban agriculture in environmental policy

A large part of city garbage is organic, but it is often simply dumped or illegally burned. Waste water and sewage sludge contain nutrients that are of high value in agriculture. Urban agriculture can help to reduce environmental pollution by recycling solid and liquid waste in the process of agricultural production.

Urban agriculture also plays a role in greening the city as a result of urban forestry and gardening (Konijnendijk 1999). It helps to capture CO_2 and dust and to improve the micro-climate (McPherson 1994), to reduce erosion and flood damage (Braatz 1993, Chimbowu 1993), to decrease urban heating (Deelstra 1999), to break the wind and reduce noise (Carter 1993), and to maintain biodiversity (Rees 1997).

Aside to these advantages, urban agriculture may also have some detrimental effects on the urban environment. Local water sources may become polluted if overly high amounts of chemical fertilisers and pesticides are used, or excessive use is made of nitrate-rich manure, like chicken or pig manure on crops (Rabinovitch & Schmetzer 1997). Urban livestock that is not integrated into horticulture or forestry systems can harm the environment through the accumulation of animal wastes. Non-farming neighbours may complain of visual untidiness, dust, smell and noise created by the urban farms.

The following measures may be applied in order to enhance the positive environmental impacts of urban agriculture and to prevent negative effects on the urban environment.

Promotion of safe re-use of urban organic wastes and wastewater by urban farmers

Measures worth considering were identified to be:

- promotion of the establishment of low cost facilities for “close to source “ collection and sorting of organic waste;
- promotion of compost or biogas production through the stimulation of applied research on composting and digesting technologies;

> <u>Examples</u>: Many examples exist of collection and composting of organic materials for re-use in urban agriculture. See Lardinois (1998) for an international overview.

- encourage investments in systems for rainwater collection and storage and for small-scale water saving irrigation systems (e.g. drip irrigation) in order to reduce the demand for treated water;
- stimulation of applied research in waste water re-use;
- introduction of preferential prices for wastewater treated to secondary level for irrigation and fully treated potable water;
- farmer education on proper handling of waste and waste water.

Examples: Several cities use treated or untreated wastewater to irrigate woodlands, orchards, pastures, grain crops, and for production of fish in treatment ponds. Untreated sewage sludge, mixed with fly ash, is applied in Orissa to non-edible trees and grasses as a good soil amendment. Examples come from Mexico City, Palestine Gaza Strip (Abdelwahed 1994)
In Lima (Moscoso 1999) a sequence of settlement ponds allows effluents of a higher quality to be safely applied at each step for a better/higher use (from woodland irrigation to fish farming). In Dakar, a treatment system combining different low-cost technologies is being developed to deliver irrigation water that meets the quality and quantity needs of market vegetables (Niang 1999).
In Cochabamba, Bolivia, periurban farmers pay for treated effluent with freshwater from their land holdings, which is distributed to the city. See also the international overview in Edwards & Pullin (1990).

Promotion of ecological farming methods

Depending on the local consumption, organic farming should be promoted. Here the following measures may be taken:

- promote farmer training and farmer-to-farmer exchange on ecological farming practices like non-chemical pest and disease management, ecological soil fertility management, soil and water conservation;
- stimulate the introduction of quality standards for compost and bio-fertilisers (nutrients, health standards) in order to make these products more reliable and more attractive in comparison to industrial fertilisers;
- stimulate the establishment of “green labels” for ecologically grown urban and safe food.;
- provide support to local initiatives for direct marketing of ecologically grown food;
- regulations for the use of chemical fertiliser and pesticides in urban areas.

Examples: The developments in Havana show the potential of comprehensive regulations in promoting organic production (Gonzalez Novo & Murphy 2000, Rosset & Benjamin 1994).

4. Social and community aspects of urban agriculture

During the conference the community impact of urban agriculture was stressed. Urban farming can provide people with a useful activity, enhances social cohesion in neighbourhoods and brings people together. Garnett (1996) describes the positive impact on women’s social well being in a community gardening project in

Bradford, North England. Creative ways to bring local government NGOs and community-based organisations (CBOs) together are also being tried in Cagayan de Oro (Potutan et al. 2000).

> Examples of the community impact of urban agriculture are found in the case studies for Sofia, London, Havana and various cities in Canada and the USA (Yoveva et al. 2000, Garnett 2000, Gonzalez Novo & Murphy 2000, Moskow 1995 and Koc et al. 1999).

As urban agriculture has the potential to improve social aspects within communities, policy measures may be considered which can further enhance these benefits. More specific policies might include:

Inclusion of urban agriculture in urban regeneration projects and Local Agenda 21 activities:

- linking urban agriculture with educational and community development activities related to urban agriculture;
- allowing for communal ownership of land in stead of exclusively private ownership;
- facilitation of direct marketing schemes and local exchange systems bringing local producers and consumers together.

5. A strategy for creating an enabling policy environment for the development of urban agriculture

The participants of the workshop recommend a series of activities oriented at the creation of an enabling policy environment for the development of urban agriculture at local and national level.

Historically urban agriculture does not have an institutional home. Organisations like a Ministry of Agriculture usually lack a political mandate for urban agriculture. Urban agriculture projects are rarely integrated in overall urban planning. Generally there is little co-ordination between NGOs and municipal agencies, and urban farmers are often not organised. Hence, stakeholders in urban agriculture lack channels to voice their needs and lack the power to participate in policy preparation and city planning processes.

To improve the situation the participants of the Havana workshop recommend a series of measures:

- The organisation of *on site meetings and policy seminars* in order to raise awareness among national and city administrators, planners and NGOs and to provide them with reliable data and positive examples (“best practices”), and to develop a broad, systems oriented perspective on urban agriculture;
- The selection of a *national lead agency on urban agriculture* and the establishment of *an interdepartmental working group at national level*. Due to the cross-sectoral nature of urban agriculture, it often lacks an institutional home. The national lead agency will stimulate development of an appropriate legal framework for urban agriculture, facilitate the creation of a national urban agriculture programme with local pilot projects, and support local initiatives for the integration of urban agriculture in city planning and urban development policies.
- The establishment of a *database on urban agriculture* with information on successful policies and projects, appropriate technologies for urban agriculture, effective and participatory planning and research methodologies, available expertise.
- The setting up of *city inter-agency committees on urban agriculture* and the establishment of *stakeholder platforms* for dialogue and consensus building at city and neighbourhood levels.
- Promotion of *participatory, site specific and interdisciplinary field research on urban agriculture* with a strong policy and action orientation.
- Stimulation of *documentation and exchange of experiences* at local, national and regional level through networks, workshops, exchange visits, newsletters, etc.
- Providing *assistance to processes of self-organisation* of urban farmers (e.g. producers’ organisations, marketing co-operatives, machinery pools).
- *Facilitating networking and dialogue* between groups and organisations of urban farmers and with consumer organisations, community-based organisations (CBOs), non-governmental organisations (NGOs), environmentally conscious commercial firms, and Local Agenda 21 groups.

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ACCRA: URBAN AGRICULTURE AS AN ASSET STRATEGY, SUPPLEMENTING INCOME AND DIETS

Margaret Armar-Klemesu and Daniel Maxwell

1. Introduction

Historically, Accra was a Ga fishing village. In 1877, the capital of the then Gold Coast, as Ghana was known before its independence in 1957, was moved from the Cape Coast to Accra. Accra is located on the east coast of Ghana, almost on the Greenwich meridian, and approximately 5 degrees north of the Equator. The climate is hot and humid, with mean temperatures varying from 24 ^{o}C in August to 27 ^{o}C in March. Rainfall is rather low, averaging 730 mm per year and falls mostly during the months of June, July and October (Ghana-MLG 1992).

Administratively, the Greater Accra Metropolitan Area is made up of the Accra Metropolitan Area and the sub-metropolitan districts of Ablekuma, Ashiedu Keteke, Ayawaso, Kpeshie, Okaikoi and Osu Klottey, the Tema Metropolitan Area and the immediate periurban area of the Ga district. The geographic areas included in this case study are the adjacent cities of Accra and Tema and their immediate peri-urban hinterlands.

The Greater Accra area accounts for 13 percent of the total population of Ghana. The city of Accra covers an area of 17,362.4 hectares and has an estimated population of 2,500,000. Population density is on average 100 people per ha, but varies from 20 people per ha in the newly developing high income areas to as high as 400-500 people per ha in the most densely populated, low-income neighbourhoods (Ghana-MLG 1992).

Ghana's economy declined from 1965 to 1983. This resulted in a general decline in living standards. The economy grew a little after the initiation of the Economic Recovery Programme in 1983, but this did not significantly improve the living conditions of the majority of Ghanaians, as prices of food rose faster than wages.

In Accra, poverty even increased and living standards declined in contrast to a decrease of poverty levels nationwide. Concerns about this led to a study on livelihoods, food and nutrition security in the Greater Accra Metropolitan Area.

At a stakeholder's meeting preceding the study, urban agriculture was identified as an important element to be included in the study. Virtually all the material presented in this case study has been extracted from the two reports on the overall Accra Urban Food and Nutrition Study and its component, Urban Agriculture in the Greater Accra Metropolitan Area.

2. Urban agriculture in Accra

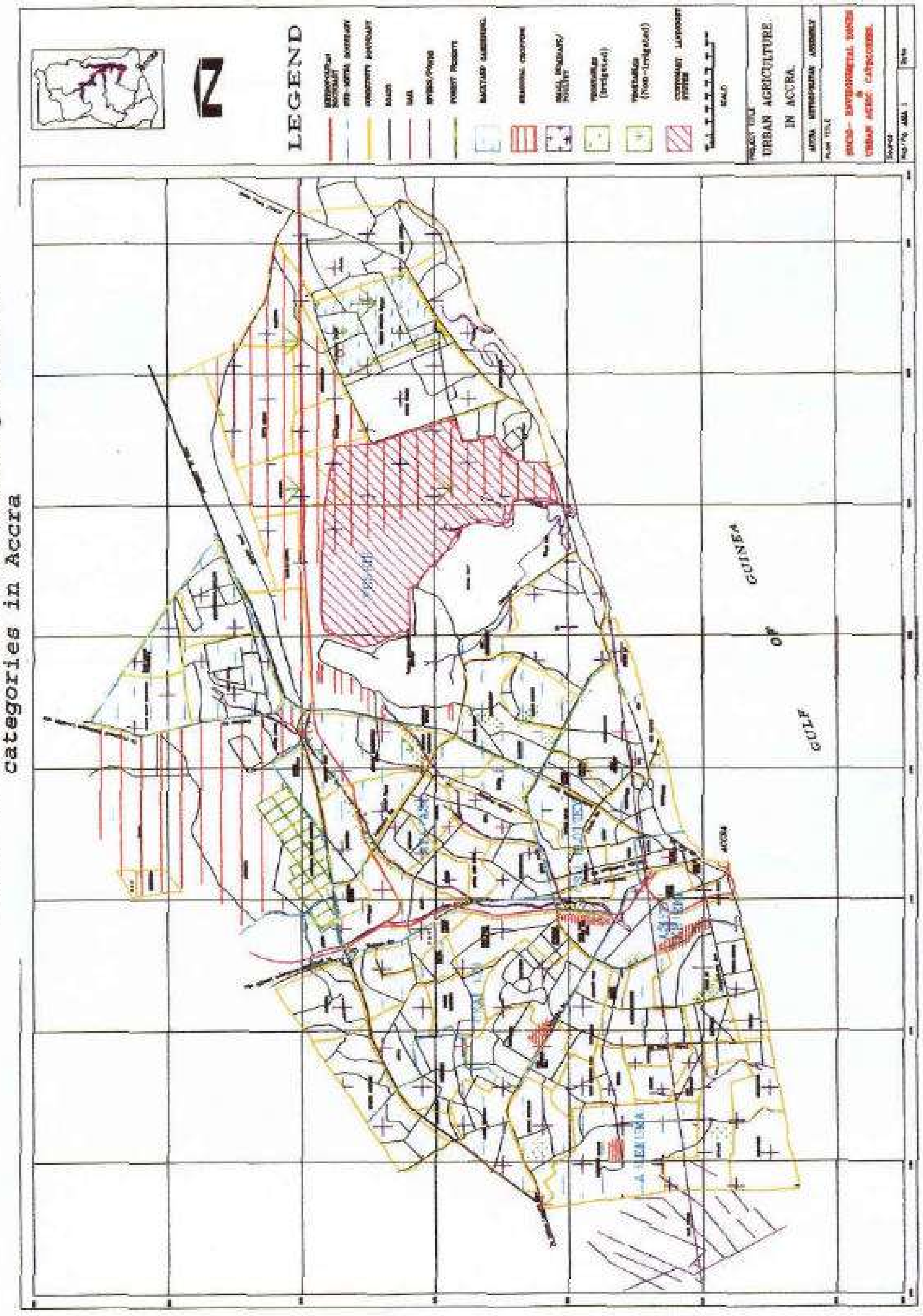
Out of 559 respondents in 16 enumeration areas in the Accra Urban Food and Nutrition Study (1997), a total of 88 reported a family member being engaged in some form of agriculture; 11 reported fishing as a livelihood. Of those engaged in agriculture, 12 farmed in their home villages outside the city and therefore outside the study area. The remaining 76 households, or 13.6% of the total sample, engaged in agriculture in the immediate urban or periurban area. Of these, 19 engaged in crop production, 49 in livestock production and 8 in both. The results give a good overview about urban agriculture but, since the number of respondents was small, it is difficult to draw hard conclusions.
Staple crops like maize and cassava are the most common crops. Vegetable production ranks slightly lower, with peppers, okra and tomatoes being the most widely grown. A wide range of other crops is grown in small amounts, like beans, cabbage, lettuce, cucumbers and other vegetables; plantains, sweet potatoes, other starchy tuber crops; and fruits, including pineapple, bananas and tree crops.

By far, poultry is the most commonly kept livestock. Over 70% of those keeping livestock reported keeping chickens or ducks. Small ruminants come second, with about 20% raising either goats or sheep. Only very small numbers of swine and various micro-livestock are kept. In all cases, the number of animals per household was relatively small: the greatest number of poultry was 40. Over 90% of people kept less than 10 animals.

Relatively few households were engaged in urban agriculture. Farming ranked ninth as a primary livelihood category, but ranked second as a secondary activity, and second as a tertiary activity. Other activities in which farmers engage include skilled and unskilled labour, and petty trading. Few patterns of income-generating activities emerged from the analysis. Men combining a day-time activity like farming with a night-time job such as watchman was one of the few that did emerge. Women often combine agriculture with petty trading.

The commodity traded, however, is rarely agricultural produce, and when it is, it is even more rarely one's own - trading is usually an off-season activity.

Figure 2. Location of major urban agriculture categories in Accra



Major vegetable growing area in Dzowulu, along power lines and adjacent to a major residential area. Construction in vicinity of power lines is prohibited (Picture Margaret Armar-Klemesu).

Typical backyard livestock keeping near the Campus of Ghana University (Picture Margaret Armar-Klemesu).

2.1 Analysis of urban farming systems

Farming, in particular the keeping of small livestock, is fairly evenly spread across income groups. Only for vegetable growers and periurban farmers is crop cultivation the main activity. Much of the farming in the city is on household property, but informal access to land is also important.

2.1.i Vegetable-growing systems

Farmer characteristics (11 farms observed)
Generally, men dominate this category of farming. Quite a number are young school leavers and school dropouts who could not find other jobs. They cut across almost all the ethnic groups in Ghana and even include people from other West African countries. The majority of the young men are part-time farmers, while almost all the older men and women are full-time farmers. Those who farm on a part-time basis do so to supplement their income. For most of the farmers, including the part-timers, vegetable growing is their main source of income. The Vegetable Growers' Association, with an estimated 600 members, represents about a quarter of all vegetable growers in the city. The association does not have a clearly defined marketing strategy for the produce of its members.

Farming practices
Vegetable farming mainly occurs along big drains and streams, the water from which is used for irrigation. In a few cases, water from water pipes is used. Vegetables are grown throughout the year. Each farmer has only a small plot of land and practises intensive crop rotation to maximise the use of land, maintain the soil fertility, and rid the soil of pests and disease. As many as four different types of crops are grown on the same piece of land in a year. Vegetable farmers prefer the use of cow dung and chicken droppings as fertiliser because they are cheap. Some farmers use agrochemicals to treat their crops for pests. Mulching is also practised.

The extensive use of water polluted by human, animal and industrial waste has caused public criticism. The critics argue that this practice makes the vegetables dangerous to human health. The farmers themselves, however, doubt whether their produce is any more contaminated than vegetables bought in the market.

Crops grown include exotic vegetables such as lettuce, cabbage, carrots, sweet pepper, French beans, beetroot and herbs, which need intensive care. The farmers do almost everything themselves, without resorting to hired labour. This explains why farmers can be found on their farms all day, and do not engage in direct marketing. The activities involve preparing beds for planting, applying compost, frequent watering of plants, and continuous weeding. Wives and children of the farmers do not usually assist the men, on account of the distances between the farms and the homes.

Produce and its use
The seeds for the exotic vegetables are usually imported. Also local vegetables are grown, like okra, pepper, tomatoes and green leafy vegetables important in the Ghanaian diet. During the rainy season, some farmers also plant a few staple crops, such as maize for home consumption.

Vegetables produced are almost entirely for sale, though a few local crops and maize are for home consumption. Usually, farmers have trading women are the farmers' regular customers, who buy whole beds of vegetables even before the crops mature. This allows the farmer to plant subsequent crops quickly and avoid extra costs of delay. In some cases, these market women give capital credit to the farmers and, when the crops are ready, buy them. In other cases, market women buy vegetables on credit and pay the farmers after selling. Other customers are individuals and some foreigners who buy for domestic use. Farmers confirmed that, although individual buyers offer a better price, the market women are a more reliable source of income.

2.1.ii Customary land-rights systems

Farmer characteristics (9 farms observed)
All the people in this category are located in the eastern part of Accra, between Labadi, the Ghana International Trade Fair Centre, Burma Camp and Teshie; the farmers, who are mostly Ga people from La, have customary land rights. The owner of this land is the La Stool (one of the Ga chieftaincies in Accra). All those born into the clan have usufruct rights to the land. A few people rent land for farming in the area. These people either do not come from La, or belong to clans or families in La who do not own land. The chairman of the La Farmer's Association estimated that about 400-500 people are farming on La lands.

Women are more involved in farming on customary lands than in other systems. The women have very little or no education and no skills other than trading, which some of them do during the dry season. Most men have had some formal education, usually up to middle school. Most have some skills in carpentry, masonry, driving or mechanics. All the farmers live in the nearby La township and go to their farms in the morning, or after working hours and on weekends. Both men and women have access to land; however, women tend to have smaller plots than men, which is partly due to labour constraints. Husbands do not offer any help to their wives on the farms. Men, on the other hand, have access to their wives' labour. In some cases, groups of women, mostly sisters or other relatives, farm together, using a piece of land inherited from their father or a common ancestor, though some groups borrow or rent land. Tasks on the farms are not differentiated according to gender. However, women who usually farm with their husbands are more involved in the planting and harvesting of crops and the men do the work of weeding and clearing, as well as planting, spraying and harvesting.

Farming practices

Most farmers practise monocropping, with some intercropping and use of a crop rotation. Farmers use chemical fertilisers and insecticides in considerable amounts, as extension officers have taught them farming techniques and the proper use and application of chemicals.

Cow dung and chicken droppings are also used, and the use of compost is increasing because of the high cost of chemical fertiliser together with rising doubts about its effect on the soil. Previously, the sewage-treatment plant located in the area provided a source of irrigation water for most of the farms there. However, with the breakdown of the plant, some farmers use the raw sewage as the only alternative for irrigating their farms.

Most labour is household-based, and includes both men and women. Primary tillage is usually done with a hired tractor, but this is expensive and difficult to acquire. Before ploughing by tractor, the farmer has to uproot all young trees and tree stumps on the farm. When an entire household provides labour for farming, women and children usually help during the peak periods. When women farm by themselves, they have to rely on either help from their children or on hired labour, which increases their operating costs.

Produce and its use

Produce is either sold or used for home consumption, depending on the crop. Maize and cassava are subsistence crops and mainly used for home consumption, though some are sold when there is a particularly good harvest. Cash crops include okra, watermelon, pepper, cow peas, tomatoes and sometimes maize. These are sold to wholesalers who sell them in the markets in central Accra. A few women farmers and their spouses have stalls at the market and sell directly to the public.

2.1.iii Seasonal farming

Farmer characteristics (13 farms observed)
As a norm, men engage in seasonal farming. Most of them are married and have other additional jobs. Without exception, they are migrants, mainly from northern Ghana or Sahelian countries further north. Some of the men reported assistance from their wives on the farm at certain periods (see below). Women mostly farm with their husbands. Occasionally, a widow takes over land from her late husband, and sometimes a woman will get access to some land on her own and farm by herself. Even where women are involved in farming, they are very reluctant to call themselves "farmers".

Farming practices
Seasonal farming relies entirely on rainfall. The farmers invariably use land that has been informally accessed. This type of farming is found all over the city, but predominates in the low-density areas with open spaces, such as periurban fringes and undeveloped residential, educational and industrial sites. The farmer uses his own labour almost exclusively. Extra labour is rarely employed, but in some cases, especially during planting and harvesting, wives and children assist the farmer. Farms are small and farmers live quite far away from their land, which makes it difficult for other household members to participate. Most farmers in this group own bicycles, which make the transport to their farms easier.

Produce and its use
Mainly food crops are grown, most commonly maize, but also cassava and beans are common. Crops grown for sale include tomatoes and pepper and, in a few cases, okra, groundnuts and other specialised crops. Since this type of agriculture relies on informal access to land often located far away from the household, it is unusual to grow high-value crops or to keep livestock.

Average yields are low (2-3 bags of maize/acre). Total harvests reported were in the range of 1- 5 bags. For a typical household, this amount of maize was reported to be enough for three to four months, and up to six months in some cases. In only one case did a household actually produce enough staple food to last the whole year; both husband and wife were full-time farmers without other sources of income.

2.1.iv Commercial livestock

Livestock-keeper characteristics (5 farms observed)
Raising livestock commercially differs from the keeping of small ruminants and poultry by virtue of its scale and market orientation. Most of the commercial livestock keepers are men ranging between 30 and 50 years of age, the older men being more established in the business. They are married, cut across all ethnic groups and have some level of formal education. Some women also engage in commercial production. Most rely on assistance from hired labour, as the scale of operation is quite large and cannot be managed by household labour alone. The Ghana Poultry Farmers' Association exists to meet the needs of poultry farmers by providing feed at reduced prices.

Livestock-keeping practices
The main livestock kept for commercial purposes is poultry and pigs. The keeping of poultry is more prevalent in middle/high-income communities, which can afford start-up costs. Much of this activity takes place on the outskirts of the city, but some occurs within Accra, despite bylaws controlling the practice. Waste from livestock is generally disposed of at the refuse dump, though a few keepers sell refuse to crop farmers for fertiliser use. In lower-income neighbourhoods, pigs and even small ruminants are commercially raised.

2.1.v Small ruminant and poultry farming systems

Livestock-keeper characteristics (8 farms observed)
This group is by far the largest farming category within the city. The keeping of some animals in homes is a common feature in almost all communities in the city, but especially in low-income migrant communities. The survey showed that only 8-9% of low-income migrant households do not keep such livestock. Both men and women are involved in the keeping of small livestock, most also have other forms of employment, and most are married. The majority of those keeping small livestock and poultry are women, assisted by their children. Their husbands do not usually contribute to the upkeep and care of the animals. When men are the owners, they have access to their wives' and children's labour, which is not the case for women who keep livestock.

Farming practices
The environment in which the animals are kept varies from one community to another. In high-density, low-income communities, poultry are allowed to move freely and share the same limited compounds with other household activities. Goats and sheep are confined for fear of theft. Plantain and cassava peels and

leftovers from “chop bars” are collected and fed to these animals. In high- or middle-income low-density neighbourhoods, however, where fewer households keep animals, they are penned and given specially prepared feed, and obtain the services of veterinary officers. Labour is provided by household members; this includes the feeding and cleaning of pens and compounds. Hired labour is not used.

Produce and its use

The livestock kept includes chickens, goats, sheep and ducks. In some cases, livestock may provide a regular source of income or a source of supplementary food for the household. In the majority of cases, however, small livestock represent a kind of asset strategy. Young livestock (especially chickens) is bought cheaply and kept at low cost, since these animals scavenge for much of their upkeep. The animals can be readily sold for cash if a crisis arises. Sometimes a crisis may be a simple shortfall in cash to buy food, but more commonly it involves major expenses such as school fees, a medical emergency or a funeral.

2.1.vi Backyard gardening

Farmer characteristics

This system basically comprises the cultivation of crops for home consumption. It is usually carried out within the compound, especially in middle- and high-income, low-density neighbourhoods and newly developing estates. Backyard gardeners are mostly middle-aged men and women with some level of formal education. Apart from providing households with some food, the quality and safety of crops from backyard gardening are appreciated and ensured. Often, the whole family is involved in planting, weeding and harvesting. In most cases, labour is not hired, as plots are small. Backyard gardening is invariably a part-time activity that supplements people's regular incomes and, in some cases, it is regarded as a hobby.

Farming practices

Backyard gardening is carried out throughout the year and both rain and piped water is used. Intercropping is normal practice, as several crops are usually planted on the same piece of land. However, a few crops, like maize, are grown as sole crops during the rainy season. Mainly animal dung as well as other household wastes are used as fertilisers. Very few agrochemicals are used. Most backyard gardeners prefer to grow their crops free of chemicals to ensure that healthy crops free of contamination are harvested.

Produce and its use

Crops grown in the backyard include vegetables, legumes and maize, especially during the wet season. Some backyard gardeners grow fruits like citrus, not only to enrich their diets but also to provide shade and an airy environment for their houses. All of the production is for home consumption. In a few cases, where the harvest is plentiful, not all food is consumed by the household and some is given away or sold to generate extra income.

3. The impact of urban agriculture on food security, nutrition and health

Farming is done for three main reasons: namely cash (vegetable growers and commercial livestock group); food subsistence (seasonal, customary land rights and backyard farming groups); and assets to be sold in case of an emergency (small ruminants and poultry group).

Data were collected between January and March, a time of year when seasonality of income would be roughly average for the year; that is, between the harvest season when income from farming would have peaked, and the lean season when income would be close to zero.

With a few exceptions, cash income from urban farming is low (varying from US$20 –30 a year to several hundred dollars a month) and seasonal. The exceptions are predominantly in vegetable farming and commercial livestock production. Income from the sale of own stock forms an insignificant proportion of total household income. Nevertheless, for households in a cash-flow crisis, it contributes a substantial portion to income during the crisis period - nearly 15% of total household income for the previous month for those reporting distress sales. There is substantial evidence that food consumption is cut when a cash-flow crisis occurs, implying that strategies to accumulate assets have a direct impact on food consumption during household cash-flow crises.

Three specific kinds of impact in terms of direct access to food can be distinguished:

- farmers who produce enough maize and/or cassava to provide their households with staple food from one to eight months of the year;
- a small group of farmers who use cassava as a kind of food reserve so that, during times of the year when other staple foodstuffs have run out and no household cash is available, cassava is eaten; and
- most of those interviewed, including wives of farmers who were not directly engaged in farming, noted that farming is part of livelihood diversification

strategies. It helps to minimise the risk of an overall shortage of income, and thus reduces the household's overall vulnerability to food insecurity.

Only about 1% of food at the household level comes from direct production in urban agriculture. In farming households, in terms of value and calories, about 7.5% of total food originates from urban farming. Among seasonal farmers and the customary land rights group, enough staple (usually maize) can be harvested to provide as much as two-thirds of the household's annual needs.

No positive association of urban farming with child nutritional status was found. Several reasons can be suggested for this. Firstly, many households engage in farming, particularly the keeping of small ruminants, because it is an "asset strategy". The assets provide cash through sales in an emergency, or are a source of direct food at special times. However, this strategy has relatively little impact on the general nutritional status of the family. Secondly, data were not collected at a time that cash income or consumption from agriculture would have been at a peak. Lastly, most farming in Accra is practised by men. While some of the produce is consumed within the household, income from urban agriculture is less distinguishable from other forms of male income in terms of the impact on food and nutrition security.

It is, however, clear that farming within the city is an important component of the city's food supply system, as the bulk of the city's supply of fresh vegetables comes from local production. There is still room for policy and programme initiatives to support and develop the sector further.

3.1 Health implications

There is little doubt that the water from the streams and drains used to irrigate much of the city's vegetables is heavily polluted with both industrial and human waste. Irrigating with these waters is prohibited, but the bylaws in question are never enforced.

To ascertain the microbial status of vegetables grown in Accra, lettuce samples were collected from a variety of sources: urban farmers relying on drainage water for irrigation; farmers relying on tap water; and retail vegetable sellers at major markets in the city, where it was not possible to trace either the location of production (rural or urban), the conditions of production or the potential contamination of water sources. The samples were analysed under standard laboratory conditions (Armar-Klemesu et al. 1998).

The levels of mesophilic bacteria detected in all the samples were high but unacceptably so in the market samples. Both the farm and market samples were contaminated by coliforms, faecal coliforms and *E. coli*. International standards do not allow any of these contaminations. Perhaps more worrying is the fact that pathogenic bacteria of any public health significance (i.e., Salmonella and Shigella spp) were detected in both market and farm samples.

Samples that were watered with tap water tended to be least contaminated by all types of bacteria tested. Farmers who used drain water tended to produce lettuce with more faecal coliforms and *E. coli* than those who used tap and other sources of water. Similarly, enteric pathogens were detected on lettuce irrespective of method of irrigation. It was observed that farmers used cow dung and chicken droppings as sources of manure, which is likely to be the source of this contamination. However, using animal manure is not exclusively associated with urban production.

The results show that, while tap water irrigation does decrease the level of contamination at the farm-gate level, the major sources of bacterial contamination of fresh vegetables may draw from the distribution, handling and marketing system, rather than from the production.

Table 1: ***Level of contamination by location of sample collection***

	Levels of contamination				
Location	**N**	**Total counts 1**	**Total *Coli* forms 2**	**Faecal *Coli* forms 2**	***E-coli* 3**
Farm	66	4.8 (1.0)	4.3 (0.9)	3.3 (1.6)	3.1 (0.8)
Market	60	5.2 (1.2)	5.0 (0.9)	4.7 (0.8)	3.6 (1.1)
Total	**126**	**5.0 (1.2)**	**4.7 (1.0)**	**4.0 (1.5)**	**3.5 (1.0)**

Notes: ANOVA. Standard deviations are in parentheses.
1. $p<0.05$; 2. $p<0.001$; 3. $p>0.05$
Source: Armar-Klemesu et al. 1998.

4. Urban agriculture and the environment

Potential environmental benefits of urban agriculture are: the recycling of urban waste products (and substituting chemical fertiliser), the greening of vacant plots which otherwise would be used as garbage dumps, and the production of vegetables for the urban market, without incurring the congestion and pollution of long-distance transportation.

One of the adverse impacts is the improper use of agrochemicals in densely-populated areas, creating hazardous run-off that poisons the city waterways. Although many of these are already contaminated, agrochemicals are a special cause for concern. Agrotoxins are potent and many users are unaware of the potentially harmful impact. Of even greater concern is the impact on human health of growing vegetables using contaminated water and the uptake of industrial pollutants by plants.

Accra has only one wastewater treatment plant. At the time of the study, the plant was not functioning, though the pond into which the treated effluent is discharged was being used for irrigation. Virtually all helminths and most bacteria and viruses can be removed by ponding. Wastewater can supply almost all the nitrogen and most of the phosphorus and potassium required by crops, as well as micronutrients. The pond effluent contains a lot of algal biomass, which acts as a slow-releaser fertiliser. The benefits of utilising wastewater for urban agriculture in Accra, however, require further investigation.

In appendix 1, farming practices and associated environmental impacts are summarised.

5. Contribution of urban agriculture to the household economy

For the seasonal farmers and backyard gardeners, the main reason for urban agriculture is to produce for household consumption, home gardening mainly complementing the diet. Among seasonal farmers, in many cases, a major portion of household consumption comes from their own produce. Both these groups are fairly small in number.

To generate cash income tends to be the main goal for vegetable growers and commercial livestock raisers. In these groups, the entire household may depend on the income from the agricultural enterprise, but little of the produce is directly consumed. Some of the livestock producers time their production so that they are able to sell during festive occasions when prices are more favourable. Vegetable growers produce year-round.

The "asset" rationale tends to dominate among the keepers of small ruminants and poultry on a small scale. While these households may consume some of the meat from the animals at the time of festivals, in general the animals are neither slaughtered for home consumption, nor are they regularly sold for a steady cash income. The average value of assets is about US$50. This figure is much higher for sheep, goats and pigs than for poultry. The negative mean income (the investment in the asset being higher than liquidation of the assets in the year prior to the sale) from small ruminants and poultry production confirms the asset strategy.

The customary land rights group tends to produce both for home consumption and for sale. The miscellaneous group also tends to have different rationales. Vegetable growers and commercial livestock producers obtain higher annual incomes from urban agriculture. They usually also have higher levels of education.

Overall, roughly half of all produce is consumed within the producing household, but this makes for a very small proportion of total consumption, even among such households. The proportion of produce consumed directly by the household of the producer is considerably higher among the seasonal farming and periurban farming groups. The survey captured too few backyard gardeners to draw hard conclusions.

Table 2: ***Socio-economic characteristics of farming systems***[1]

Farming System	**Sex**		**Median annual farming income (per enterprise)**	**Proportion of harvest consumed**	**Average years of education**
	Male	**Female**			
Seasonal	7		41,600 C[2]	58.6%	8.1
Customary land rights	-	1	-	-	7.0
Vegetable growing	1	-	375,000 C	-	1.0
Backyard gardening	1	-	12,300 C	74.5%	15.0
Small ruminants / poultry	19	24	-1,000 C	-	7.9
Commercial livestock	1	-	452,000 C	-	17
Periurban mixed farming*	6	2	90,000 C	36.8%	9.4
Periurban crop farming*	12	4	36,000 C	53.9%	10.8
TOTAL	**47**	**31**	**8,000 C**	**49.3%**	**9.0**

* Subgroups of the seasonal farming system
Source: Zakariah et al.1998.[3]

6. Gender aspects of urban agriculture in Accra

Over 60% of those actively engaged in agriculture in Accra are men. Male farmers mainly give cultural reasons as to why women do not farm. Most of the farmers are migrants, mostly from the north of Ghana, or countries in the Sahel where traditionally women do not farm by themselves. Other reasons given by men related to the tediousness of the work and the difficulty in acquiring land.

Women tend to give more economic reasons. Some wives of male farmers said that, if their husbands were farming, it made more sense to do something else, so that if they had a bad year for farming, the household would still have some income. A second reason is the distance between household and farm[4]. This cost of going back and forth is one restriction, the need to be around the home and to look after children, another. Thus, as a first choice, most women prefer to engage in activities close to the household, such as trading. Most of the women in agriculture are engaged in keeping small livestock.

In Accra it is common for a husband to give his wife a certain amount of money for the purchase of food ("chop money"). Food from farming simply constitutes the contribution of the man towards the household. The wife often has to make up any shortfall through her own sources, hence the pressure for her to have another source of income. Non-farming wives report that they do not sell any of the food contributed by their husbands. The husbands report selling some food (which the wives clearly did not know about). Thus, farming is a source of cash income for men, as well as a source of food for the household.

Incomes are "pooled" only in terms of fixed contributions to consumption. Only rarely was one member of the household farming, while the other adult was engaged in selling. The most common explanation is that it is better for husbands and wives to keep their income-generating activities separate, to avoid disagreements over income.

Few differences were noted in the types of crops planted, though women tended to plant more pepper, because it is a less labour-intensive perennial crop. The men plant more watermelon, okra and tomatoes as cash crops.

The only aspect of farming where a gender division of labour is clearly noted is the marketing of crops, which women dominate. The women or farmers' wives sell directly to consumers or to wholesalers, who are also women, in most cases. Virtually all farmers, both men and women, said that by tradition men do not sell at the market. It was culturally unacceptable for men to carry their loads to the market.

7. Existing policies regarding urban agriculture

Urban farming received a big boost in the mid-1970s with the "Operation Feed Yourself" by the then government, in response to food shortages. City residents were encouraged to use their backyards and all empty spaces for crop production, at least for home consumption. The programme was heavily patronised but declined in the 1980s as people lost interest because of improvements in the food situation and as land being used for farming was lost to housing.

Currently there is no explicit policy for urban agriculture in Ghana. Neither is there any provision for urban agriculture in urban planning. The Ministry of Food and Agriculture formulates agricultural policy in Ghana generally irrespective of whether it is being undertaken within the urban, periurban or rural setting. Perhaps the closest thing to a policy on urban agriculture is the Accra Metropolitan Assembly bylaw ("Growing and Sale of Crops", August 4, 1995), which prohibits the watering and irrigation of crops by the effluent from a drain. Planning and control over the rapid change in land use has been inadequate; moreover, land management has received little attention under the various World Bank projects to support urban development.

Research initiatives highlighted the benefits of urban agriculture for urban livelihoods and food security, as well as concerns about the use of wastewater. Research also indicated the need for a more pragmatic holistic approach to address the latter, as the problem of food contamination is not just a question of wastewater irrigation.

The Accra study, in particular, provided valuable information on the changes in land rights and livelihoods in the periurban areas of the city. This was used in the development of land-use policy and guidelines for dealing with land-tenure transformation in periurban areas for the new national land-use policy document, which has just been formulated.

The main problems in urban agriculture as mentioned by the producers are:

- land both in terms of access and tenure security, which is at the top of the list of most groups, although this is less of a constraint for keeping small livestock
- theft of crops grown far from the household;
- marketing, both physical space for the activity and the organisational arrangements necessary to permit and promote direct farmer-consumer selling;

- high production costs coupled with lack of credit facilities; and
- the use of polluted water for irrigation from the drains and streams.

In contrast to some other African cities, harassment by municipal authorities was not very frequently mentioned as a serious problem.

Especially in the periurban areas, where farming is the main livelihood, access to agricultural land is a cause for concern. The rate at which land is being converted from agricultural to urban uses is alarmingly high. In the period from 1990 to 1993, roughly 2,100 ha per year were converted from agricultural to urban use. Between 1993 and 1997 this increased to 2,600 ha and it is probably even higher in 1998. Apart from outright loss of agricultural land due to urbanisation, there is a growing destruction of the agricultural resource base through sand mining ("sand winning") in areas around the city.

Up to now, farming communities coped largely by pulling back, squeezing in and shortening the fallow cycle. It is becoming increasingly clear, however, that sooner rather than later, more of this will not be possible. What will people who depend on agriculture do, when that point is reached?

8. Perspectives for the development of urban agriculture

The formal and informal economic sectors of the city do not generate adequate income for the poor urban population. At the same time, urban agriculture supplements both diets and incomes of the urban poor, even in confined spaces. Therefore, urban agriculture should be regarded as a component in urban food systems.

The average income from farming may be low and farming may not have a big impact on household food security; however, it should be realised that, for those whose primary livelihood is farming, income from farming can be appreciable.

There is a need for deliberate intervention in the land market to reserve land for agricultural purposes if periurban agriculture is to survive.

Fortunately, the Ministry of Food and Agriculture has decentralised and today there is a Metropolitan Director of Food and Agriculture, who is the official link between the Ministry and the metropolitan authority, with jurisdiction over urban agricultural affairs. There are signs that several of the recommendations from the study are already being implemented. These will go a long way toward protecting and promoting urban agriculture in Accra, and follow below.

8.1 Integration of urban agriculture into land-use planning

Urban agriculture is missing in most planning designs, because of the idea that "real" agriculture takes place in rural areas. The time has come to start integrating urban agriculture into urban planning. Especially for the periurban areas, the proposed law to establish greenbelt zones to halt urban development activities should be enacted and enforced.

8.2 Urban agricultural land management

Technical advice and training for farmers by agriculture extension officers is offered and should be sustained. Aspects of the training include soil erosion control techniques and bio-intensive farming practices to enhance soil fertility and check soil degradation.

8.3 Water resource management

The Environmental Protection Agency (EPA), in collaboration with the Metropolitan Assembly and the Water Research Institute, should put into place measures to minimise the pollution of water sources by farming. This could be achieved through the provision of guidelines and standards. At the farmer level, awareness of water pollution and of the benefits of water conservation and source protection should be promoted.

8.4 Control of wastewater discharges into surface/groundwater

According to the 1995 AMA (Growing and Sale of Crops) bylaws, it is an offence to water crops with effluent from a drain. Both the enforcement and bylaw compliance have been virtually non-existent. Alternative approaches to the problem, such as intense public education on both acceptable environmental and food hygiene practices, should be a priority. At the farm level, farmers should be encouraged to use groundwater sources instead of surface water. The use of boreholes to provide safe water for irrigation is currently being advocated.

8.5 Promoting use of organic manure

Farmers are already using organic manure (poultry droppings and cow dung). The Ministry of Food and Agriculture, in collaboration with environmental

NGOs, should sensitise more farmers on the advantages of using organic manure. A policy to maximise re-use and recycling of city organic waste should be vigorously pursued with the Waste Management Department in order to make organic manure available, safe and cheap.

8.6 Improving livestock management practices

The Ministry of Food and Agriculture, in collaboration with the Metropolitan Assembly and Veterinary Services, should provide farmers with guidelines and specific advice for proper livestock management practices. There is a need to educate farmers regarding the use of the guidelines (control and disposal of animal faeces, skinning of animals, etc.).

8.7 Institutional co-ordination

The Ministry of Food and Agriculture should play the lead in co-ordinating all stakeholders involved in the promotion, management and operation of urban agriculture. The creation of the position of Metropolitan Director for Food and Agriculture has given urban agriculture the official recognition it deserves. The necessary institutional co-ordination needed to develop urban agriculture is being put in place. At the farm level, the existing Farmers Association should be strengthened. Such an institutional arrangement will be useful for a two-way flow of information on environmental management practices between farmers and decision-makers.

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1 It should be kept in mind that the small number of cases makes solid conclusions impossible.

2 C = Ghanian Cedi. At the time of data collection 1 US$ = 2000 C. Since then the Cedi depreciated to around 6000-7000 C to 1 US$.

3 Most of these households are located in the densely-populated, low-income areas of the city, but the land for farming lies mostly on the outskirts.

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Appendix 1: ***Summary of field data on current farm practices and operation of urban agriculture in Accra***

Farming system	**Land and land-use characteristics**	**Farming practice**	**Environmental issues**
Vegetable farming	• flat or gently sloping land; • wetland or nearness to water course and flood-prone areas; • sandy-clay to sandy-loamy soils; • open space; • undeveloped urban land for other uses where water is available; • service reservations and road corridors; • near school, industries and high-tension reservation.	• using simple tools; • no specific timing for any activity; • no farm extension services provided; • small-scale operation and farm size; • contiguous farm lots; • practising crop rotation; • irrigating crops with water from streams or dugouts which were previously fed with tap water; • cultivating same site for long periods; • removing all top soil; • creating planting beds.	• better use of undeveloped land or land used for dumping of refuse for urban agriculture; • illegal piped-water tapping for irrigation; • discharge of waste into surface water, altering water quality; • water and soil erosion; • siltation of waterways; • declining soil fertility; • chemical pollution and soil contamination; • introduction of new exotic species of plant and increasing barrier to normal replenishment of existing species; • poor-quality water (dirty, opaque or chalky, traces of oil and faecal matter) at Avenor; • no solid and liquid waste generated; • recycling of vegetable waste for mulching observed at Burma Camp; • use of herbicides and pesticides.

Livestock farming	• located along watercourses (Korle/Odaw River); • low-lying lands liable to flooding; • located in high-density low-income communities and open spaces; • land bare of vegetation; • poorly managed urban open spaces; • proximity to grazing sites.	• no land prepared, livestock either confined to wooden structures or free-range grazing; • feeding on grass and cassava peels and "chop bar" leftovers; • varied degree of dependency on veterinary services; • limited medication for sheep/goats; • water from tap water; • farmers forming association; • poor farm management practices; • varied degree of scale of operation, average 30 x 30 m space; • storage of animal feed on site; • slaughter process using car tires for burning; • all domestic animals: goats, sheep, pigs, chickens; • collecting wastewater in dugout or channelled to the main stream.	• solid waste (faecal) collected and deposited along watercourse; • wastewater collected into small dugouts and some channelled direct into lagoon; • contamination from wastewater into stream • unhygienic and unsanitary butchering of livestock; • air pollution from tyre burning as a result of skinning of animals; • smell from feed and left-overs and improper dumping of waste; • livestock-vehicular accidents and nuisance.
Seasonal farming	• undulating land, slopes varying from 2-5%; • relatively poor soils; • coastal savanna and scrubs; • vacant public and institutional lands (e.g. University of Ghana).	• clearing, slash and burn; • some use of tractors for ploughing; • labour-intensive techniques for planting, harvesting, etc.; • inadequate advice from Agricultural Extension Officer; • poor crop yields; • use of chemical fertilisers.	• waste pollution from agrochemical very minimal; • vegetal waste for composting; • post-harvest losses; • pressure from urban development to relocate/replace farming activity; • conflict with livestock users.

Customary Land Right	• flat, undulating land; • grassland savanna; • wetland or nearness to watercourse and flood-prone areas; • sandy-loamy soils with loose topsoil; • army barracks, Trade Fair Centre being overtaken by new housing development.	• clearing and ploughing; • some extension services provided; • chemical and organic fertilisers used; • average farm size about 2 acres; • farms not contiguous; • rainfed but limited watering in dry season; • recycle weeds for compost; • grow vegetables and legumes; • rechanneled water flow during floods;	• declining soil fertility; • water and soil erosion; • increasing rate of flow of surface runoff and consequent siltation of river; • alteration in the course of flow of floodwaters; • reduction of the habitat for some animal life leading to migration; • proximity to other urban land uses; • emerging housing developments and land ownership conflicts; • stream polluted by sewage from Burma Camp Treatment Plant.

Source: Anku et al. 1998.

URBAN AGRICULTURE IN CAGAYAN DE ORO: A FAVOURABLE RESPONSE OF CITY GOVERNMENT AND NGOS

G.E. Potutan, W.H. Schnitzler, J.M. Arnado, L.G. Janubas and R.J. Holmer

1. Introduction

Cagayan de Oro is a boomtown located on the central coast of Northern Mindanao in the Southern Philippines. Its total land area is about 48,885 ha. Of this area 44.7% is classified as agricultural and 38.4% as open space. Annual rainfall is 1,600 mm per year. The mean annual temperature is 27 ^{0}C.

About 500,000 people presently live in Cagayan, predominantly in urban areas. The annual population growth is 4.4%, compared to 2.3% nationally. Since 1960, the population has doubled. The number of households increased to 84,085 in 1995 - an increase of 21,589 households since 1990. The average household size declined from 5.4 persons to 5.1 persons over the same five-year period. Eighty-two percent of the population lives in urban areas. Population density is 3,519 persons/km^2 in urban *barangays*[1] and 203 persons/km^2 in periurban[2] ones. The average population density is 876 persons/km^2.

The population of Cagayan de Oro is young; the median age is 20.6 years (National Statistics Office 1997). Thirty-seven percent of the population is between 0 - 14 years, 61% is in the productive age group between 15 - 64 years and 2.4% is 65 and older.
Agriculture employs about 9% of the total economically active population (City Planning and Development Office 1995).

In Cagayan, 79% of the land is periurban and 21% is urban. Topographically, the city covers: a) 33,000 ha of coastal land (ca. 70%); b) 12,000 ha of hilly and mountainous land (ca. 25%); and c) 3,800 ha of riparian land (ca. 5%). Of the 22,000 ha allocated by the city for agriculture, only 2,276 ha (10%) is used for crop production. Some farming occurs on steep and rocky "marginal" areas, of which another part is dedicated to forestry. Though actual figures are not available, it is estimated that about 50% of agricultural areas are solely dedicated to agriculture.

The soils in periurban barangays are regarded as first class, while the commonly found soils in urban barangays are regarded as second class.

Table 1: ***Actual land use in Cagayan de Oro City***

Actual land use	Area (ha)	Percentage (%)
Agricultural	21,845	44.7
Open spaces	18,775	38.4
Residential	4,669	9.6
Others	2,751	5.6
Industrial and commercial	815	1.7
Total	**48,885**	**100.0**

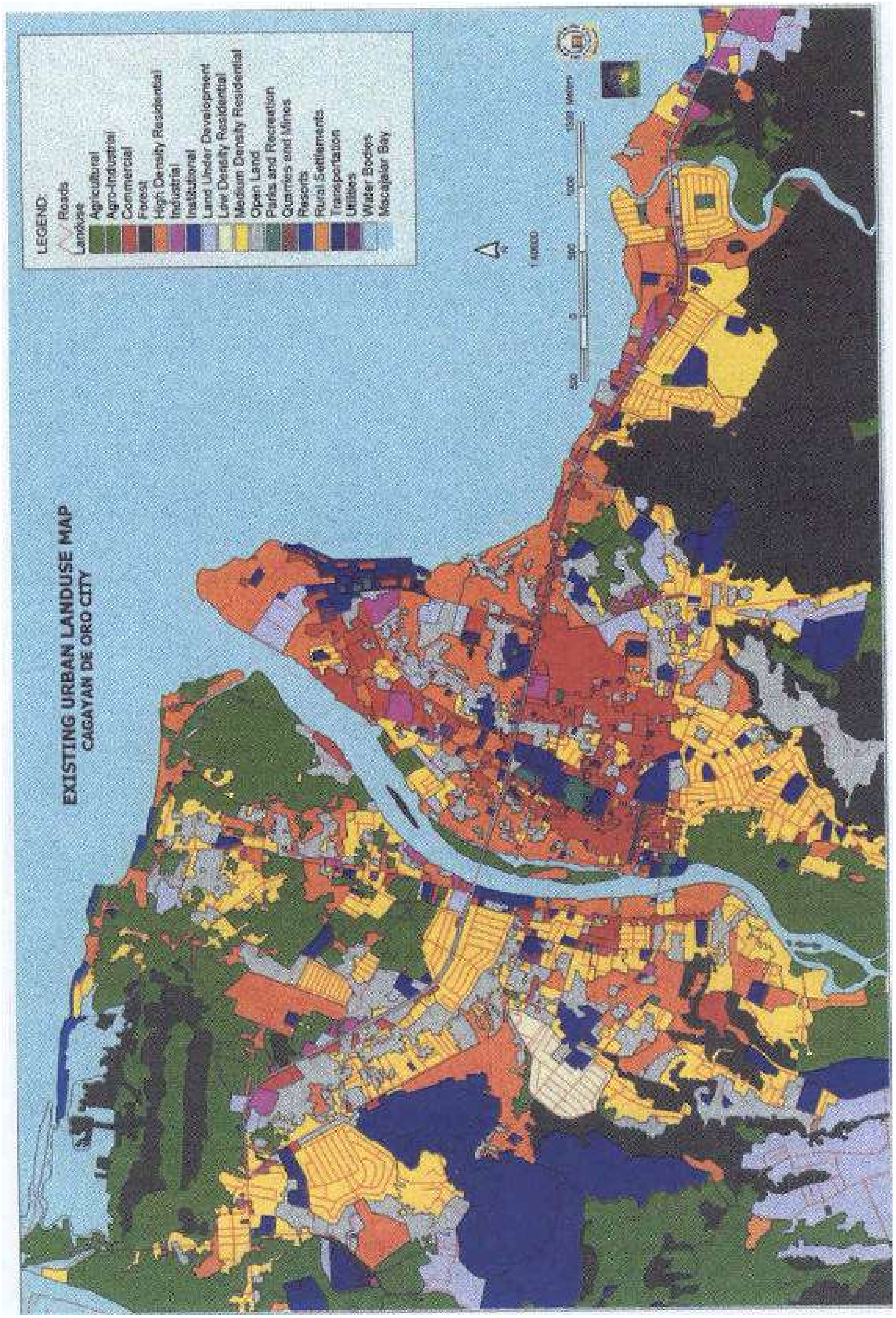
Source: Cagayan de Oro City Assessment Department 1995.

Most agricultural lands are situated in periurban areas. This land is largely owned by private individuals who have tenants to till the land. More than 18,000 ha covering the coastline, parks and plazas, all river islands and all areas designated for approved commercial and residential subdivision plans, are classified as open spaces. Some of the open spaces in both urban and periurban areas are used for urban agriculture.

2. Urban agricultural production

In the periurban areas of Cagayan de Oro, some 13,000 small-scale farmers and tenants (of whom 3,000 are women) produce on 2,276 ha of land (1995). They produce rice, maize, banana, coffee, root crops, fruit and vegetables, for both home consumption and market sales. The production is characterised by monocropping.

Farmers report many constraints in urban crop production: pests, limited knowledge on appropriate inputs, poor infrastructure, high rates for additional labour, lack of capital, limited access to land, and adverse climatic conditions such as excessive temperatures.
Levels of crop production in Cagayan de Oro are lower compared to the neighbouring rural provinces of Bukidnon and Misamis Oriental, which are situated in upland areas.


EXISTING URBAN LANDUSE MAP
CAGAYAN DE ORO CITY
LEGEND:
Roads
Landuse
Agricultural
Agro-Industrial
Commercial
Forest
High Density Residential
Industrial
Institutional
Land Under Development
Low Density Residential
Medium Density Residential
Open Land
Parks and Recreation
Quarries and Mines
Resorts
Rural Settlements
Transportation
Utilities
Water Bodies
Macajalar Bay

Backyard vegetable garden at Camilla Homes, Lumbia, Cagayan de Oro (Picture Periurban Vegetable Production Project).

The City Government encourages efforts of various agricultural stakeholders (Picture Periurban Vegetable Production Project).

Table 2: ***Agricultural production in Cagayan de Oro City[a] and neighbouring provinces Misamis Oriental[b] and Bukidnon[b]***

	Cagayan de Oro[a]		Misamis Oriental[b]		Bukidnon[b]	
CROP	**Area (ha)**	**Volume (t)**	**Area (ha)**	**Volume (t)**	**Area (ha)**	**Volume (t)**
Maize	1,162	1,813	8,150	15,066	195,710	402,558
Rice	115	455	3,242	7,470	71,490	288,420
Coffee	65	39	5,988	3,228	23,640	19,478
Fruit	579	12,420	2,179	25,220	35,766	375,026
Root crops	304	2706	1,029	7,344	10,016	88,399
Vegetables	55	560	791	5,336	1,642	18,059
TOTAL	**2,280**	**17,993**	**21,379**	**63,654**	**338,264**	**1,191,940**

a) 1995; b) 1990

Source: City Agriculture Office; Department of Agriculture Region X, 1995.

2.1 Periurban vegetable production

Some farms specialise in commercial vegetable production. The average farm size is 1.7 ha and on average 0.5 ha is planted with vegetables. On 55 ha, or 2% of the cultivated area close to the city, vegetables were grown in 1995 (City Planning and Development Office 1995).

Most farmers grow eggplant, squash, string beans, tomatoes, bell pepper and bitter gourd. The yields of bell pepper, tomato and eggplant in Cagayan de Oro are less than half of those obtained in the upland areas (such as in Bukidnon). This indicates that the varieties grown are not well adapted to the climatic conditions in the lowlands. Findings of the Periurban Vegetable Project (PUVeP) survey among 100 vegetable farmers showed that, for 44% of the farmers, vegetable production is their only source of livelihood (Potutan 1998).

Of the vegetable farmers, 46% extract water from a river or stream, 20% from deep wells, 11% from irrigation canals and 12% depend entirely on rainfall. Eighty-six percent of the farmers reported that they applied chemical fertilisers; 82% actively controlled pests, diseases and weeds in the last three crops, of which 90% used insecticides, 36% fungicides, 4% herbicides and 50% natural control measures. Of those who applied synthetic pesticides, 49% personally encountered ill effects the last time they sprayed, including headache (55%), nausea (31%) and chest pain (14%).

Of farmers questioned, 24% had heard of the government Integrated Pest Management (IPM) programme and 12% of them had received training. The impact of IPM training was ambivalent, as 36% of farmers increased their level of pesticide use after receiving training, 36% maintained the same level of pesticide use and 73% just changed the commercial brand of their pesticides. Only 27% reported that they decreased the level of pesticide application and used less toxic chemicals after receiving IPM training.

Vegetable farmers mentioned more than 15 constraints to higher levels of vegetable production. The most frequently mentioned constraints are unfavourable climatic conditions (63%), insect damage (53%), lack of capital (53%) and irregular water supply (23%). Among other notable limitations to vegetable farming were the presence of plant diseases (7%), poor soil fertility (7%), poor water quality (5%) and a lack of access to marketing facilities (3%).

2.2 Livestock

The livestock - including poultry - industry in the city can be categorised into commercial and domestic production. In 1995, production reached 158,000 head, of which 135,000 were chickens (see Table 3). There is only one slaughterhouse in the city, which also caters for neighbouring towns. It is inadequate to cater to the needs of the growing population.

Table 3: ***Livestock population in Cagayan de Oro (1992-1995)***

Species	**1992**	**1993**	**1994**	**1995**
Carabaos	1,593	1,609	1,367	1,411
Pigs	10,237	10,204	13,986	12,399
Goats	3,523	3,523	3,337	3,252
Cattle	4,570	4,581	5,245	4,010
Horses	453	462	424	409
Chickens	75,000	74,999	74,874	135,072
Ducks	--	--	--	1,350
Total	**95,376**	**95,378**	**99,233**	**157,903**

Source: City Veterinary Office.

Animals kept for home consumption are also slaughtered at home. No data have been recorded as to how much meat is produced by livestock reared at home.

2.3 Other types of urban agriculture

2.3.i Backyard gardening

Backyard gardening is common. The City Agriculture Office (CAO) estimates that about 40% of all households (94,672 in1997) maintain backyard gardens. These produce mainly leafy vegetables, fruits and ornamental plants. The fact that this practice is common in both urban and periurban areas signifies its economic importance: families can save on food items, which they would otherwise have to buy. In addition, most households own domesticated animals.

2.3.ii. School gardens

Ninety-six percent (75 out of 78) of public elementary schools in Cagayan de Oro maintain a school garden. This activity is pursued by pupils as part of the school curriculum and supervised by principals and teachers. The size allotted for gardens ranges from 500-1,000 m^2. The pupils usually plant leafy vegetables, fruits, ornamental and herbal plants. In some schools, parents are involved in maintaining and guarding these gardens. School administrators adopted bio-intensive gardening, designed for pupils to learn urban agriculture in both formal and informal education approaches.

2.3.iii. Agroforestry

Some reforestation projects for the production of mahogany and other trees have been implemented in Cagayan de Oro, mostly on hilly land in the Lumbia, Malasag and San Simon barangays, about 10-15 km from the town centre. Some 30 subsistence farmers have acquired access to these government lands through their local leaders (*barangay captains*). They plant mainly vegetables and maize under the trees.

2.3.iv. Aquaculture

As Cagayan de Oro is a coastal city, marine fishing is dominant. Six hundred full-time and 797 part-time fishermen provide about 70% of the demand for fish in the city (CAO estimate, 1998)

Aquaculture has not yet gained popularity among city farmers. This could be explained by the lack of knowledge about appropriate aquaculture systems, relatively high investment costs and the limited technical assistance. In light of the city's growth and the availability of brackish water, the government may give more attention to aquaculture development by providing adequate financial and technical assistance.

At the moment, 18 urban farmers (6 full-time and 12 part-time) engage in aquaculture, producing mainly tilapia, milkfish, and prawn/shrimp. The production is small-scale and market-oriented, in ponds of 3-6 ha in size. The average production of milkfish is 40 kg/ha.

2.3.v. Plant nurseries

Plant nurseries focus on the production of fruit-tree saplings or ornamental plants, mainly for parks and plazas. No concrete data related to the area coverage and the actual number of farmers engaged in this activity are available.

3. Food security, health and nutrition

In Cagayan de Oro, vegetables are considered a “poor man’s food” rather than a “luxury food”. There are two factors associated with this. Firstly, compared to meat and fish, vegetables are cheaper in the city. Secondly, vegetables are readily accessible, as they are widely grown in backyards, small farm lots and school gardens. Farming families, because of their low income, eat more fish and eggs than meat (Potutan 1998).

The estimated daily per capita consumption of vegetables is less than 75 grams, which is consistent with findings of similar surveys (Philippine Association of Nutrition 1997). This is far below the recommended daily human intake of 200 grams of vegetables necessary to assure sufficient vitamin and micronutrient supply (AVRDC 1996). Daily consumption of vegetables is highest among farmers (85%) and lowest among consumers in the higher socio-economic classes (64%). Respondents belonging to the higher class have by far the greatest meat consumption (78%); this was lowest among farmer respondents (7%). This suggests that, while urban farmers belong to the poorer economic classes, they have a healthier diet because of their farming.

There are differences between the crops available in the market and commonly consumed crops. This difference is attributed to home garden production (40% of the households do backyard gardening). In other words, a large proportion of consumers do not purchase all of their vegetables from the market.

A PUVeP survey among 302 pupils (average age 7.86 years and average weight 19.11 kg) found that 69% of the pupils are malnourished. Among the malnourished children, only very few belonged to households with backyard gardens. Numerous children among the well-nourished group came from families who had backyard gardens and earned an adequate income from other sources (PUVeP 1998).

Some farmers' practices pose risks to human health. Ninety-two percent of the respondents wear protective garments when administering pesticides. Often only partial protection is possible, as most farmers use an incomplete or inappropriate set of protective clothing (Potutan 1998).

4. Urban agriculture and the city environment

Daily, about 250 m^3 of city waste is disposed at the city sanitary landfill site in Barangay Carmen. It is estimated that about 60% of the waste materials are organic. This could be used for organic fertiliser production if appropriate technologies and management approaches were available.

A PUVeP survey (Potutan 1998) found that 25% of all respondents (periurban farmers) produced compost. The city government is presently cooperating with the PUVeP in collecting fruit and vegetable leftovers from the wholesale market in Agora, which are used for different experiments regarding composting technologies and compost application for certain vegetable cultivars.

Some of the periurban farmers are using government lands for crop production. For instance, a group of "eco-aides"[3] petitioned the government to use unused areas of the landfill site for production. Not only do the farmers recycle organic waste by making compost of it, they also guard the area from illegal dumping and building. Other groups of farmers use the lands covered by reforestation projects by planting various crops under the trees. Since they are using government lands, they are responsible for guarding the seedlings/trees and keeping out scavenging animals.

5. Urban agriculture and the household economy

Traditionally, farming falls under the male domain, while women are responsible for household chores like cooking, cleaning and laundry. However, marketing of agricultural produce is mainly a women's task: 73% of vendors of agricultural products are women (Arnado et al. 1998, Potutan et al. 1998). According to most vegetable vendors, on average they earn about 25% over their capital outlays.

The closest estimation on farmers' earnings is the PUVeP survey, which found that net farmers' earnings are on average about 30% of their production costs. Farmers spent a weekly average of 50 PhP on the purchase of vegetables, but all other respondent groups spent 100 PhP on the same. As farmers, on the other hand, consume more vegetables, this strongly indicates that farming significantly contributes to in-kind family income.

To both farmers and sellers, the seasonality of vegetable supply is an issue. Among the farmers, 30% reported occasional oversupply of vegetables during the harvest season; 20% said they had problems with regard to limited market display area, and 13% said that middlemen dictate vegetable prices. Among the wholesalers, 40% mentioned lack of supply of vegetables as their primary concern, 20% remarked on limited display area in their market, and 13% mentioned cheap wholesale prices. Among the retailers, 23% mentioned lack of vegetable supply, 22% limited display areas in the market and 21% lack of capital.

Small-scale food processing from urban agricultural production is promoted in the city with the City Agriculture Office (see below) taking the lead role. The products pursued are peanut butter, cashew nuts, banana chips, longaniza sausage, tocino ham, tablea chocolate, papaya pickles and camote candy. On average, each vendor dealing with small-scale food processing earns about 35% over total costs.

6. Policy perspective

In 1991 the Philippine Government signed the Republic Act No. 7160 known as the "Local Government Code". This law stipulates the decentralisation of powers and resources from the national level to local government units (cities and municipalities). It broadens the margin of decision-making and the area of action of local institutions. Furthermore, decentralisation is seen as a measure with which to reduce migration and, thus, to avoid conflicts and congestion in urban centres. In this respect, the city of Cagayan de Oro is exercising its full powers in terms of devolved functions, including the delivery of agricultural services.

Shortly after the passage of the Local Government Code, the City Agriculture Office (CAO) was established. Since then, the CAO takes responsibility for all matters relating to urban agriculture. The CAO facilitates several agricultural activities in Cagayan de Oro including: a) agricultural extension services; b) Cagayan de Oro Greening Project; c) fisheries sector improvement; d) social forestry sector improvement; e) Farming Youths Development Programme; f) home management extension services; and g) strengthening of farmers' co-operatives.

The objective of the agricultural extension services is to assist growers in farm management and to help farmers adopt appropriate farming technologies. Projects under this programme include Sloping Agricultural Land Technology, Farmers' Field School (IPM), Barangay Nursery, Scion Grove Establishment and many more. The Cagayan de Oro Greening Project aims to promote planting around the city. Projects under this programme include park maintenance and seedling production. CAO extends assistance to improve the fishery and forestry sectors by strengthening fishermen and forestry co-operatives. The Department of Trade and Industry (DTI) in the city provides training in small-scale food processing of fruits and vegetables. The CAO also provides training on livelihood and income-generating projects among wives of farmers. Among these are swine and backyard cattle fattening, handicraft and soap-making, and low-cost recipes.

Through PUVeP initiatives, the City Government is now more aware of the importance of urban agriculture, but collaboration is mutual, as the City Economic Enterprise Department (CEED) has been supporting the project ever since it started. The CEED facilitates the provision of organic wastes from the markets to PUVeP as well as to urban and periurban farmers needing them.

The media such as local TV stations (e.g. ABS-CBN) and newspapers (e.g. Goldstar Daily and Sunstar) cover most of the PUVeP activities. These institutions are essential in promoting support for and creating awareness of urban agriculture among farmers and the public alike.

The City Government classified almost 50% of the city's total land area as agricultural. Maximising the use of this area for better agricultural production will surely enhance the farmers' capability of managing small- and medium-sized farm enterprises.

The City Council passed several ordinances relating to urban agriculture. Most of these laws pertain to budgets and approval of CAO-sponsored projects, such as the Greening Project and the provision of agricultural extension services. A substantial part of city laws allows for the provision of strong opposition by the City Council towards undertakings that pose a threat to the environment.

For instance, City Ordinance No. 3031-94 opposes the construction of industries in Barangay Malasag’s reforestation area.

7. Factors affecting the development of urban agriculture

The support of the city government for urban agriculture is manifest in proposed legislation pertaining to home gardens, school gardens and access to government lands for periurban and urban farmers. But planning, policy initiatives and program monitoring are still limited and scattered. Policy-makers need to be more aware of the importance of integrating urban agriculture into urban planning and budgeting.

Two factors contributed to the city government's favourable response to the development of urban agriculture: firstly, the realisation of the potential of urban agriculture for enhancing food security (through research by Xavier University, PUVeP and other research institutes) and secondly, there is a critical mass of advocacy by farmer groups, and on behalf of farmer groups by NGOs, with respect to urban agriculture in order to create more income.

However, the success of integrating urban agriculture into general policy has been limited thus far. There is no general plan that brings together the different urban agriculture activities, and there is limited support extended to aquaculture, school gardens, and livestock, including poultry. Overall, the city is just in the initial stage of developing economically and ecologically sustainable agriculture.

Working methods and procedures regarding the planning and implementation of urban agriculture projects are not holistic, e.g. socio-economic status, cultural practices and existing development structures are not well considered. Through an integrated approach, areas of production, consumption and marketing of urban agriculture products must be equally assessed.

In the 1998 PUVeP study, several potential constraints were identified regarding the socio-economic interactions of periurban vegetable consumption, production and marketing in Cagayan de Oro. The reasons for low vegetable consumption are attributed to lack of information and educational campaigns (i.e., poor consumer guidance regarding the nutritional value of vegetables) and cultural dietary tastes. Possible reasons for low vegetable production are limited knowledge on appropriate inputs, poor infrastructure, high labour rates, limited access to land, climatic constraints such as high temperatures, attack from insect pests and lack of capital. Vegetable marketing constraints may be attributed to poor policy formation and regulations, social aspects such as the involvement of middlemen, product varieties, standard operating practices and a lack of market display areas and capital.

To address these constraints, it is recommended that partnerships of all stakeholders in urban agriculture be strengthened. Already many NGOs have been assisting the development of urban agriculture in Cagayan de Oro by strengthening collaboration, most notably with local administrations and municipalities. However, to some extent, co-ordination between NGOs and local government is not well defined. Each of these institutions has different perspectives on how to implement agricultural activities.

8. Community participation activities

Activities at the local level are backed by a sustained flow of information through the media and by successful co-operation of NGOs and government. A network of NGOs called the Philippine Partnership for the Development of Human Resources in the Rural Areas (PHilDHRRA) is instituting tripartite partnership among People's Organisations (POs), NGOs and Local Government Units (LGUs). The approach has been adopted among different farmer groups in the city (specifically, one assisted by the Mindanao Consortium for Agricultural Research and Rural Development - MinCARRD).

The tripartite approach has a clear process. First, an NGO will assist a farmer group (PO) in organising a co-operative. It deploys a community organiser to facilitate basic training in management, bookkeeping, marketing and gender sensitivity. Then the community organiser will train farmers in how to link with government agencies, such as the CAO, the Department of Agrarian Reform and the Department of Agriculture. After three years, the NGO will pull out from the community so that the farmers' organisation is able to stand on its own. This approach proves to be effective in most communities, as it is comprehensive and integrated.

In conclusion, we feel that the prospects for the further development of urban agriculture in Cagayan de Oro are promising:

- farmers are interested to be trained and to apply better farming technologies to improve yields and the quality of their products and thus improve agricultural production;
- institutional support for urban agriculture is increasing on account of a) successful project showcases; b) tripartite partnerships between local government, NGOs and POs; c) collaboration between various agencies - a clear example is the CAO, which has been co-ordinating its activities closely with PUVeP as well as with NGOs in the city; and d) legislation in support of urban agriculture; and
- agroecological awareness of stakeholders is critical. An integrated approach improves information, planning and all other activities in the field of urban planning, food production and marketing. Networked information on specific technical and environmental issues stimulates people into further action and strengthens the awareness of decision-makers. Therefore, research and community action must be promoted.

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1 The term "barangay" refers to the smallest local administration unit.

2 Cagayan de Oro has 57 periurban and 23 urban *barangays*. The term “periurban” in this study refers to *barangays* within the municipality, located at the periphery of the urban center. The city government classifies these still as *rural barangays*. These barangays are rapidly changing, particularly through the construction of industrial, commercial and residential complexes. *Urban* barangays are closest to the city centre. The population density is relatively high and some infrastructure is available (e.g. paved roads, telephone, public transport, education, hospitals, shopping malls, retail and wholesale markets, etc.).

3 So-called “eco-aides” collect waste like plastics, paper, glass and metal, and sell this. The earnings of a scavenger can be as high as PhP 500 per day (US$ 12) (personal comment, City General Public Services Office, 1998).

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CAIRO: URBAN AGRICULTURE AND VISIONS FOR A "MODERN" CITY

Jörg Gertel and Said Samir

1. Introduction

Cairo, the urban centre of Egypt, has experienced numerous transformations which shaped its social and spatial structure in the course of its long history (Abu Lughod 1971, Raymond 1993). A complex urban structure now exists, which bears the imprint of different phases of development. Modern urban architecture with a post-modern style is located side-by-side with centuries-old buildings; and inner city slums border directly on high-rise buildings with mirror-glass windows. Greater Cairo is a typical mega-city, with ca. 13 million inhabitants living in three municipalities (Cairo, Giza and Qaliyãbáya).

Table 1: ***Egypt and Cairo - basic figures [a]***

	Egypt	Cairo	Unit	Year
Population	[b]60,792	[c]13,144	Million	1996
Annual population growth	2.35	1.9	%	1994
Cultivated area as % of total area	2.9	7.9	%	1990
Urban population as % of total	43.0	---	%	1996
Life expectancy at birth	66.7	65.5	years	1994
Infant mortality rate (per 1,000 live births)	31.8	34.2	1,000	1993
Adult literacy rate 15+	52.3	70.8	%	1994
GDP per capita	3,461.3	5,630.2	LE[1]	94/95
Non-poor as % of total population	52.0	[d]55.0	%	95/96
Agriculture labour force (15-64)	29.6	0.8	%	1995
Agriculture product (% of GDP)	16.2	n.a.	%	94/95

a) The tremendous social and economic inequalities within Egypt and Greater Cairo are not reflected in the statistical information; b) The population in 1996 is calculated on the basis of 1993 data, assuming an annual growth of 2.35%; c) This refers to Greater Cairo. All following data refers to Cairo municipality, if not indicated otherwise; d) Data refer to all urban areas in Egypt.
Source: INP 1996.

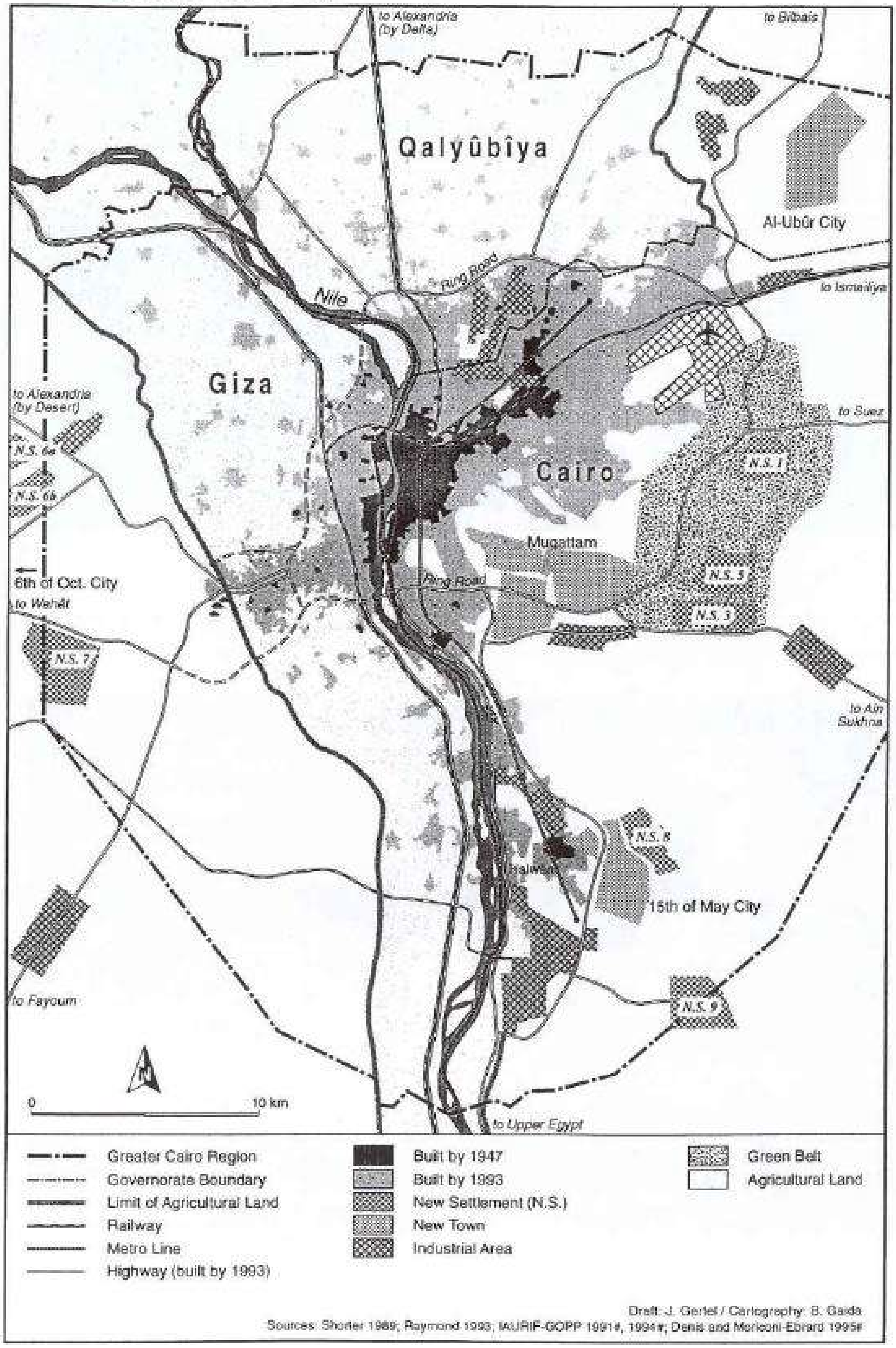
Within this relatively small but agglomerated area, various groups with immense income disparities live next to each other. The agglomeration is still growing but not as fast as the Egyptian population as a whole. However, Cairo faces one of the highest population densities world-wide (32,000 people/km^2). In some neighbourhoods more than 100,000 people live on one square kilometre - often in buildings no more than five or six storeys high. Located in an arid landscape, there is thus precious little space available which could function as green space, and there are almost no private gardens suitable for cultivation. Urban farming is thus chiefly restricted to small livestock production.

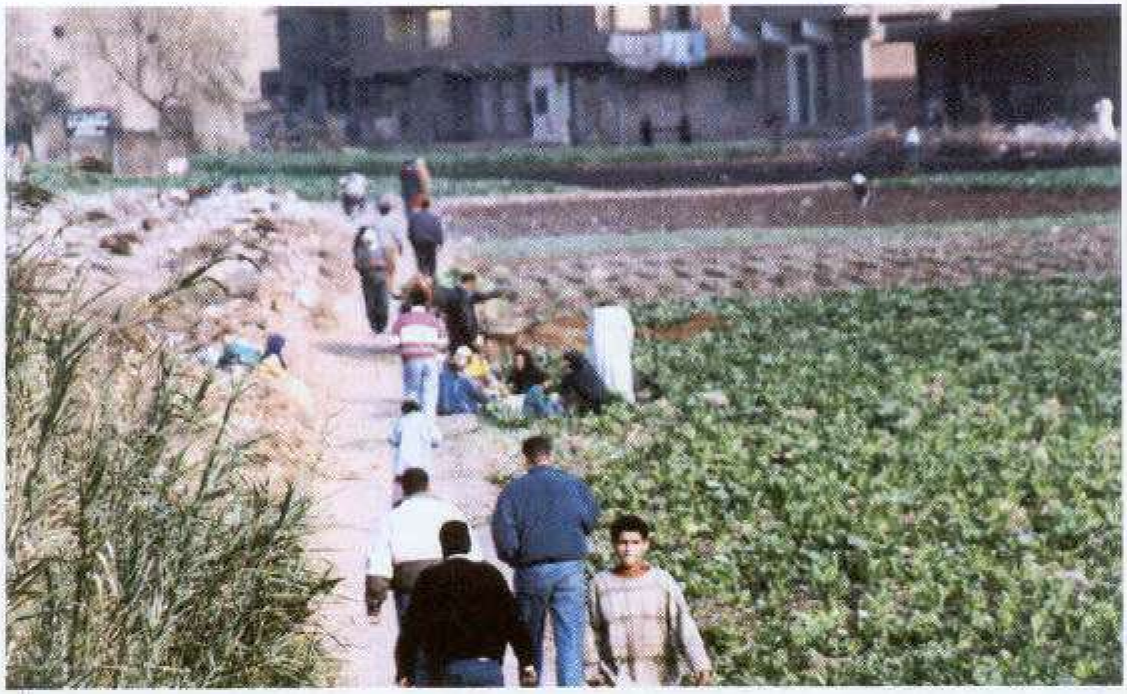
Two current developments make small livestock farming and subsistence food production particularly important: the national food production deficit and the recent steps towards macroeconomic deregulation.

Egypt has an extremely limited area of arable land relative to the size of the country. Only about 3.5% of the country‘s area can be used to produce anything of agricultural value. In addition, the Egyptian population of about 62.5 million people (1998) is increasing by about 1.3 million people per year. Therefore, domestic food production is less and less capable of satisfying the growing demand. Especially for wheat, the most important staple food, the country has to cope with a huge food gap. Hence, Egypt is one of the countries most dependent on food imports. At times, it has received more food aid than India and Bangladesh (World Bank 1992), and it has to (commercially) import about 55% of its total wheat requirements, predominantly from the United States.[2] However, only when Egypt’s economic situation and the conditions of urban and rural poverty are considered is the tremendous significance of the problem revealed. Almost half of the population is considered poor and lacks the purchasing power to access a comprehensive diet (INP 1996, 25). The political implications become clear if one realises that the Egyptian population obtains over 90% of its energy requirements from plant products; in 1991, for example, grain - predominantly in the form of bread - made up 70.7% of the energy supply, while (expensive) meat accounted for only 1.9%.[3]

In Cairo, this precarious situation first became dramatically visible with the “IMF-Bread-Riots” in 1977. Pressured by the International Monetary Fund (IMF), the Egyptian Government caused mass protests by reducing food subsidies. The protests ended only when the austerity measures were dropped. Now, more than 20 years later, the situation appears, on the surface, to be relaxed.

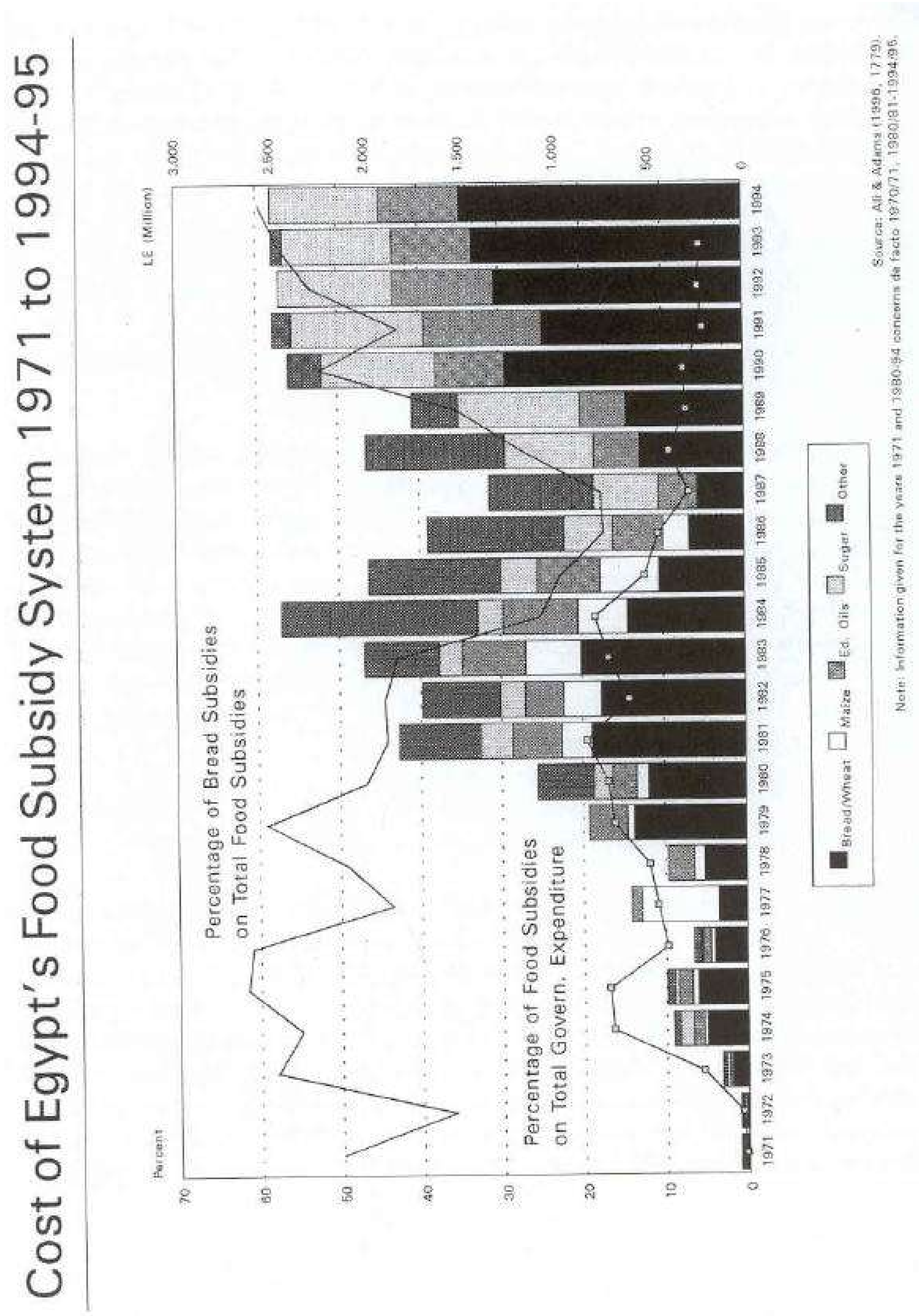
Greater Cairo Region





Crop cultivation in a former village in the southern part of Cairo (Picture Roxy Research Centre).

Poultry kept in a poor urban district in Rawd al Faraj near the centre of Cairo (Picture Roxy Research Centre)



Source: Ali & Adams (1996, 1779).
Note: Information given for the years 1971 and 1980-94 concerns de facto 1970/71, 1980/81-1994/95.

However, the present Egyptian metropolis not only contains a much larger population, but it also houses an increasing number of low-income groups. These groups massively face entitlement declines in terms of access to food. Currently, on account of market liberalisation, the centrally planned and heavily subsidised public system of food distribution, built up under Nasser and Sadat, is being transformed. Until the late 1980s, people in Cairo had access to three channels of public food provisioning:

- government outlets, selling heavily subsidised, non-rationed bread;
- licensed retail shops, distributing restricted quota of subsidised ration-card items (such as oil, sugar, tea and rice); and
- government shops, offering partly subsidised goods (such as beans, lentils, frozen meat and fish).

In the 1990s, the governmental shops were partly privatised, and the percentage of subsidies on the ration-card items and also on bread[4] was reduced. Only three items (bread, cooking oil and sugar) remain partly subsidised.[5] Again, low-income groups, who are heavily dependent on subsidised food items, are those most affected by these measures.[6] The poor not only have to substitute bread for more and more food items, but bread - in the political context - is increasingly becoming a strategic food; i.e., its local availability and affordability is determined to a large extent by (external) market forces. Within this context, urban subsistence production and, in Cairo particularly, small-scale animal husbandry take on a new importance.

2. Ongoing urban agriculture in Cairo

In Cairo, urban production of crops and livestock, including poultry, can be found. The specific structure of agricultural activities in Cairo is caused not only by the scarce urban spaces available for cultivation and the demand for cheap meat. It is also a result of food availability at the household level and comparative costs. In this respect, it is important to note that the production of fruit and vegetables in Egypt’s rural areas is provisioning the urban markets with horticultural products over the year at comparatively low prices. Thus, backyard, rooftop and balcony gardening is of little importance. At the household level, the available space is used rather to raise (expensive) poultry.

2.1 Urban crop production

Besides the rural areas in the municipalities of Giza and Qaliyãbáya, which are part of the Greater Cairo Region, there are still some smaller fields scattered around the periurban districts. In these neighbourhoods, the fields usually belonged to the villages which have been incorporated by the city. These agricultural areas - mainly irrigated by canals - are located close to residential areas. The size of the fields varies from less than one to several tens of *faddân*[9]. Very few people practise urban farming and then only on a limited scale.

Mainly clover (*birsám)* is grown on the plots. This does not require a lot of work, and yields high prices as fodder for livestock[7]. Another reason for growing clover is that the owners of these fields usually wait for permission for construction, so that they can build or sell the land. Others who have access to building licenses are speculating with the land. The agricultural use of these areas is, therefore, heavily constrained by prospects of real-estate speculation.

Al-Hagg Muhammad[8] owns a field close to the Nile near *Maadi*, a well-to-do neighbourhood. He grows lettuce on his land surrounded by skyscrapers and sells it on a local market. He also raises a couple of sheep and a buffalo for home consumption:

> *Ten years ago, I sold some of my land to a big construction company for 50,000 LE per faddân. Today the prices are up to 5,000,000 LE. I regret selling my land too early. Now I won't sell until I get the highest price or until I find a partner and we build on it ourselves.*

2.2 Animal husbandry

Some 16% of Cairo households keep animals[9], predominantly chickens, geese, ducks and pigeons.[10] Of the production, 95% is for home consumption, suggesting that poultry is the main product in subsistence farming in Cairo. In spatial terms, this subsistence production is concentrated in periurban districts but, using the housing situation as an indicator, it becomes obvious that animal husbandry is an important activity in both informal settlements and (former) villages.

More than one-quarter of the respective households are involved in it, while the group with the highest percentage is found in an informal settlement close to the city centre within a "modern" high-income area (38.0%).

Table 2: ***Spatial patterns of animal husbandry in Greater Cairo (1995)***[11]

Housing type Area	Private	Public	Informal	Rural
	Percentage of all households			
Old inner city area	7.7	6.0	24.0	---
Medium-aged & -located	17.7	6.0	8.3	---
New periurban area	10.0	7.7	35.5	36.0
"Modern" high-income area	0.0	0.0	38.0	18.4
All	9.0	5.1	28.3	27.2

Number of households surveyed = 703
Source: Field survey 1995.

One has to keep in mind that the majority of the urban population lives in what is classified as a private housing situation. It should also be noted that the subject of animal husbandry is sensitive and, in some sections of the population, specific aspects of it are even taboo. As a result, the residents of Cairo are often reluctant to disclose their poultry-raising activities or the number of chickens kept, and will remain vague on the matter even within their own social circle.

Table 3: ***Structure of animal husbandry in Greater Cairo***

Animal	**Frequency (animals)**	**Avg. Size (herd)**	**Avg. Value (animal)**	**Location (in relation to house)**		**Use (household economy)**	
	(n=1.002)	(n=151)	(Single)	Inside	Outside	Selling	Own use
	(%)	(Animals)	(LE)	(%)	(%)	(%)	(%)
Water buffaloes	1.1	2.2	2,090.9	60.0	40.0	40.0	60.0
Horses*	0.1	1.0	6,000.0	0.0	100.0	0.0	100.0
Sheep	1.3	2.6	213.1	20.0	80.0	0.0	100.0
Goats	1.5	3.0	96.0	20.0	80.0	60.0	40.0
Geese/Ducks	18.5	4.6	11.0	65.0	35.0	10.0	90.0
Chickens	66.8	8.4	7.1	60.0	40.0	4.0	96.0
Pigeons	10.7	7.1	13.5	86.0	14.0	0.0	100.0

n for households with animals = 112[12] * Only one case
Source: Field survey 1995

The structure of animal husbandry in Cairo can be further specified by two characteristics:

1) Households which possess animals are predominately nuclear households with an average of 5.5 individuals.[13] About 43.4% of these households have children under the age of 6 years. This pattern is partially explained by the fact that households living in informal settlements are mostly young

households. As they represent the majority of households with animals, they shape this demographic picture.

2) The availability of (suitable) space is limiting the possibilities for animal husbandry by single households. Of all households raising animals in Greater Cairo, 70.8% either live on the top floor and have access to the roof of the building, a preferred place for poultry production, or live on the ground floor and have easy access to a yard or to public space. This is confirmed by the average number of rooms that households dispose of, and is particularly evident in informal settlements, where 50% of all sample households with animals live.[14] It is thus not only the particular social setting of lower-income groups but also the available space that determines the possibilities for animal husbandry in the low-income quarters of Cairo.

It has to be emphasised that people who raise animals do not have a different access to formal education than do low-income households without animals. What is more striking is the extremely high illiteracy rate in general, and particularly in (former) villages and informal settlements. As a consequence, both groups (with and without animals) have restricted access to employment in the formal sector of the economy.

2.2.i Poultry

The raising of poultry is by far the most important agricultural activity. It is almost exclusively undertaken by low-income groups in densely-populated quarters of the city.

Commercial poultry production at household level is an exception. Poultry is kept on rooftops of residential buildings, in small alleys and other available spaces - often also inside houses.

Abu Nasir, a big poultry wholesaler in Cairo, told that his wife once started raising some poultry in cages in a corner of his store[15] in order to sell them later in her retail poultry shop. But the cost of feeding was high and some of the chickens got sick and died. The small profit she made did not encourage her to continue. He also indicated that raising poultry in rural areas is much more economical, because cheaper sources for feed are available and wider space, needed to keep the poultry healthy, is found there. Privately raising poultry, although a common practice, is thus not an easy task. It demands investments and experience, requires enough space and remains beset with risks, as even with expert handling the young chickens often die.

Umm-Muhammad - a housewife - is a poultry specialist. She was born in a small village in the Nile Delta and is 46 years old. Twenty-two years ago, she and her husband moved to Cairo in order to look for better opportunities:

> *Raising poultry is like a hobby for me, and is something I am used to since my childhood in the village. Prices of poultry are very high, especially during Ramaᶑân.*[16] *Raising chickens saves our budget a lot, particularly as my husband's income is not stable. I don't sell any of my chickens. Most of the time we eat them and sometimes I give them as exchange gifts to friends and relatives. Home-raised chickens are much better than the ones in the market. They are tastier because the ones in the market are injected with hormones to gain weight quickly. I heard on TV that those hormones are not very healthy. The costs are not too high. I mainly feed them with the food remains of our household, and some neighbours who don't raise chickens give me leftovers for my chickens. From time to time, I give them some eggs in return. I clean the chickens' waste continually to not bother the neighbours; still at times this gives problems with neighbours, who don't like the raising of poultry in the building and complain about the smell and the noise. They call it an uncivilised activity. I try to keep good relations with them in order to continue my hobby. I don't know! Maybe if we were rich, I would not raise chickens, but sometimes I think, if we were rich, I would have done it on a larger scale, maybe with some other animals as well if we were to have a big house of our own.*

The example of Umm Muhammad reveals that poultry raising in Cairo is a female activity, predominantly undertaken for home consumption. Compared to animals from the industrialised poultry industry, home-raised poultry is considered healthier and tastier. It also plays an important role in the household strategy of minimising expenditures, e.g. by using social networks to access cheap fodder. Although the activity is sanctioned by the local community in high-density quarters, conflicts about the use of space, the noise and other issues do arise in individual cases.

The controversial aspects of poultry raising are also illustrated in the following: While taking photographs of chickens belonging to a poultry retail shop in a densely-populated quarter of Cairo, four women - waiting to be served - discussed the issue of urban farming. Three of them agreed that they would economically benefit from poultry raising for household consumption, and emphasised they would like to practise it, but the lack of space inhibits them, as does their rental situation. According to them, many landlords either prohibit or monopolise such activities. The youngest woman, however, criticised the photo shooting. She asked if the photos will be published abroad, and said:

> *These photos are an embarrassment for the image of Cairo as a civilised city, and activities like poultry raising should be eliminated and kept for the villages. Poultry raising in the city is a source of dirt and diseases.*

Then she added:

> *A few years ago, there was a media promotion to raise rabbits in cages for home food production, but it was proven to be unsuitable for Cairo. The houses of people who need such production are too small to be comfortable for humans alone as it is and do not have enough space to share with even more creatures.*

As everyday life in Cairo is increasingly determined by external forces that are shaped by a logic that is rooted outside the local community (like TV commercials), the images of poultry production - as that of other foods - at times become a special issue and subsequently are renegotiated at the local level. Food in this respect often works as a social marker, delineating and redefining group positions (Mann 1995). The meaning of food, and in particular poultry, therefore largely extends into the local culture and carries important values beyond purely nutritional aspects.

2.2.ii Other livestock

The raising and slaughtering of sheep is a very common seasonal activity in Cairo, and - as part of a religious practice - peaks during the period before the feast of the Muslim pilgrimage. The time animals are kept varies considerably between families. Usually the animal is bought alive a few days before the feast and kept inside the house - on the terrace and sometimes in the kitchen, or on the rooftop. Some people with access to more space, buy animals young and raise them for some months. Some might even produce for the market as well. However, sheep - and sometimes cattle as well - are usually raised only for religious occasions and slaughtered on the early morning of the festive day. Well-to-do households give some of the meat to poorer people, friends and relatives, while the rest is for home consumption during the feast. The local production is usually not adequate to meet the peaking demand, and the government, in addition to private companies, imports livestock for this occasion. However, locally raised animals are considered tastier and are preferred, although they are more expensive.

Cattle raising for dairy production, and sometimes for meat production, exists mainly on a commercial basis on a very limited scale. Cattle are mainly found in periurban districts, but sometimes also within the city in densely-populated quarters.

Mustafa Zaky, a man in his early forties, raises cattle in a periurban neighbourhood of Cairo. He inherited this job from his grandfather when the district was still a village. Mr Zaky indicates that the major constraints for urban cattle raising are suitable space, high fodder prices (*birsám*), plus the problem of waste disposal. He stresses that these problems are not found in the rural areas. Although his brothers pressure him to quit his job, he continues. His brothers even gave him money to open a new store in order to sell "modern" dairy products but, instead of changing his profession, he bought two more cows, raising them in the new shop:

> *To me, the crowd of customers waiting for me to milk the cattle to buy the fresh milk is the proof that what I am doing is the right thing!*

Commercial pig raising is a special type of urban livestock production in Cairo; and is undertaken by a specific social group: the *Zabbalán (zibla* = garbage*).*[17] The *Zabbalán* collect and recycle most of Cairo's domestic waste.[18] These predominately Christian families originate from Upper Egypt and comprise between 20,000 people (Meyer 1987) and 40,000 families (Haynes & El-Hakim 1979). The pigs are raised in pigyards (*zarába*) that are attached to the living units. The animals are fed with organic waste, and sold to pig traders, who do the processing and distribution.[19] As Muslims are not allowed to consume meat and meat products from pigs, the products are bought by Cairo's Christian minority, resident foreigners and tourists. Because of their allegedly inferior activity, the *Zabbalán* live in separate settlements on the urban fringes of Cairo, and have been forced to change location several times during the last decades. Recently, the largest settlement, in *Muqaóóam*, which was already evicted from its previous location in *Imbâba* in September 1970, is again being threatened to be removed.

3. Urban agriculture and the household economy

About 59% of the households surveyed in Cairo that possess animals (n=106)[20] are living in poverty according to the *Food-based Poverty Line*.[21] If the *Lower Expenditure Poverty Line* is applied, 72.6% of the households live in poverty. The poorest of these households live in informal settlements (with an average income of 60.2 LE capita/month) and in places with a rural background (44.5 LE capita/month). In spatial terms, the poor households concentrate on the urban fringes. Thus, animal husbandry is predominantly found in economically and spatially marginalised areas within the metropolis and plays an important role in the survival strategies of the respective households, as it provides access to animal proteins which cannot be acquired otherwise.

Table 4: ***Comparison between household income and value of animals***[22]

Housing type **Area**	**Private**	**Public**	**Inform al**	**Rural**
	(LE)	(LE)	(LE)	(LE)
Old inner-city area	130.8	30.0	80.3	---
Medium-aged & -located	122.6	72.0	62.5	---
New periurban area	86.3	55.0	108.9	129.1
“Modern” high-income area	---	---	65.7	90.3
TOTAL average value of animals (LE)	**116.7**	**52.3**	**85.3**	**114.3**
Income average (capita/month, in LE)	104.7	107.3	60.2	44.5
Illiteracy rate (Head of household, in %)	31.6	10.0	70.2	55.5

(N for households = 103)
Source: Field survey 1995

A closer look at the value of animals illustrates that the ownership of animals can be considered an economic asset. Particularly in the periurban areas, where the majority of animal owners lives below the poverty line, the average value of the animals is not only relatively high; it exceeds two or even three times the monthly per capita income. On account of the restricted access to formal savings institutions like banks, it thus plays an economic buffer function. The asset can be mobilised and monetarised in emergency cases, such as to buy medicines in cases of sickness. It is also clear that animal raising carries economic risks; the death of animals, particularly if they are expensive, can pose an extraordinary economic burden on the affected households. The poorest people lack the basic economic security and means to invest; hence, they are not in a position to keep animals; and even if they would be able to buy, for example, some cheap young chickens, alternative spending (for bread or drugs) overrules this option, which is beset with economic risks.
Linked to the issue of food security is the topic of food safety and food contamination. The image of food produced in Cairo is not very positive. A woman from a low-income neighbourhood reflects the public opinion:

> *Food that is commercially produced in Cairo is always looked upon with suspicion of high contamination.*

Air pollution accumulates in water and soil.[23] A study of an industrial district in Greater Cairo assessed the concentration of heavy metals (lead, cadmium and zinc) in the soil. The soil contamination has resulted in a very high lead concentration in vegetables (El-Fouly 1996). This study demonstrates that the degree of contamination differs tremendously between Cairo and rural areas. Depending on the plant, the contamination is between 10 and 40 times higher in Greater Cairo; watercress, parsley, melon and lettuce, among others, are extremely exposed. Some agricultural fields on the fringes of Cairo, such as in *ÓIzbat an-Nakhl*, depend on untreated sewage water for irrigation; in this respect, water contamination is a serious problem demanding further research (PRIDE 1994).

Another aspect of urban food contamination is related to the demand for sheep for religious feasts. Some “entrepreneurs” commercially raise sheep in the poorer districts of Cairo and feed them on garbage from the dumpsites in the streets. The problem became clear in an interview with Muhammad Ali, who was herding about 50 sheep within Cairo.

> *Those sheep are not mine. I am here with my brother to take them out to the garbage dump twice a day for feeding. The owner buys the sheep young and has them fed with nothing but garbage, until they are sold during the period before the grand feast.*

Muhammad Ali emphasised, moreover, that the sheep are sold outside Cairo at a market that is frequented by customers from Cairo. Thus, merchants may claim a different (rural) origin of contaminated products. A governmental employee in charge of garbage collection indicated that such flocks are in all waste dumps in Cairo. However, because more detailed studies are lacking, it remains unclear to what extent contaminated food (and water) pose serious health hazards.

Table 5: ***Concentration of heavy metals in the soil of Š ubrâ al-Êaima[24] compared to a remote rural area in Egypt[25]***

Location	**Lead (ppm)**	**Cadmium (ppm)**	**Zinc (ppm)**
Near to metallurgical complex (*Šhubrâ*)	547	18,0	271
Close to glass and metallurgical work	384	5,6	230
Near to urban industrial activities	276	5,1	197
Bigam (neighborhood of *Šhubrâ*)	160	3,9	160
Remote area (Sharqiya Governorate)	15	0,2	32

Source: El-Fouly (1992, 61)

Table 6: *Mean lead concentration in edible portions of vegetables grown in Š hubrâ al Êaima compared to a remote rural area in Egypt*

Area Crop	**Cairo (*Š hubrâ*)** (ppm)	**Rural area (*Š arqáya*)** (ppm)
Lettuce	26	0.9
Melon	29	0.8
Watercress	38	1.0
Parsley	32	0.7
Tomatoes	4	0.4
Pepper	5	0.3
Carrots	8	0.5
Turnips	7	0.4

Source: El-Fouly (1992, 61)

4. Urban environment and policies regarding urban agriculture

> *I don't find any need for agricultural activities in Maóaráya [a periurban district of Cairo]. In the local council we don't encourage agricultural activities. My family has lived in Maóaráya since it was a village, but I don't think Maóaráya will be a village again. The wheel of time never goes back. When we will get rid of all remaining agricultural activities, we will be able to make of Maóaráya a nicer place to live in, even compared to Heliopolis [a well-to-do neighbourhood in Cairo].*[26]

Environmental policy is an issue in Egypt which has received increasing attention over the past years.[27] City greening, for example, has a high political priority. However, parks and public gardens are extremely scarce and are located only in low-density high-income areas.[28] Up to now, there are no official policies regarding urban agriculture in Cairo. There is no specific policy to encourage urban agriculture despite its contributions to food and income security of poor urban households. So far, the government has not regarded urban agriculture as a policy issue.

4.1 Authorities in charge

There are at least four different governmental institutions in Cairo that could be involved in promoting urban agricultural activities. However, none of them does so.

- The Governor of Cairo is the highest decision-making authority concerning planning and developing the city. On many occasions, it has been obvious

that governors were interested in increasing the green space in the city, but urban agriculture was never mentioned as a way to achieve this;
- the Ministry of Agriculture is responsible for some agricultural projects inside the city, but they are linked to research and educational purposes, such as the glasshouses along the bank of the Nile River, and agrarian land in agricultural schools;
- the Agriculture Colleges in both Cairo University and *ÓAin Šams* University run research centres with some agricultural activities inside the city, but they are only used for experimental and research purposes, simulating the rural situations. Urban agriculture is not addressed; and
- the Ministry of Health has offices in every district of Cairo. The representatives in the six offices visited emphasised that they consider animal husbandry inside the city a health hazard and a source of pollution. They investigate reported cases and inform the police, who usually stop the activities and fine the person responsible.

While small-scale animal husbandry is a vital part of the informal economic sector and important for the survival economy of low-income groups, the concept itself is not well known and not supported by the political decision-makers. Urban agriculture is considered an illegal activity.

4.2 Local scientific perceptions of urban agriculture

The academic institutions and specialised research organisations, particularly in the field of agriculture, do not show much interest in urban agriculture and there is no local literature on urban agriculture.[29]

The dean of the Agricultural College in Cairo University, Prof. Abu al-Rus, underlines that neither the term “urban agriculture”, nor the concept, is found in Egypt. He believes that one easily associates the term with large-scale industries relying on agricultural production, such as dairy and meat-processing factories. Prof. M. Nawwar, an agricultural sociologist at Cairo University, is familiar with the term, but he claims that there is no local definition for urban agriculture. He emphasises that the concept is completely unknown to policy-makers and adds that there are other concepts such as self-sufficiency and environmental awareness that might build a basis for the concept of urban agriculture to catch on. According to him, however, even these concepts are not well applied in Egypt. He also recalls a research proposal about urban agriculture in Cairo introduced by some foreign agency, but no local counterparts were interested. He concludes that urban agriculture is not suitable for Cairo, because of the lack of space. He rather favours gardening [in the form of public parks] as a suitable activity. Dr. Mahmud A. Al-Alim, an Egyptian economist and thinker, considers urban agriculture as “ruralisation of the city” and judges it as a negative trend. He comprehends semi-rural or semi-urban districts in Cairo as sources of pollution and even of crime.

In Arabic the terms “urban” (*haœar*) and “civilisation” (*haœâra*) are of the same root and are found to contradict with the term “agriculture“(*zirâÓa*) by almost all those thinkers and scientists interviewed. To quote Prof. Abd Al-Ati, head of the Social Science Department and professor of urban sociology in Alexandria University:

> *There is nothing called urban agriculture and, by definition, it is a contradiction in terms. Ruralisation of the city is a negative phenomenon, which is mainly found at the fringes of the city and should be destroyed. We aim for seeking greater civilisation, while this is aiming for more ruralisation!*

These statements offer a very strict reading of the term “urban agriculture” and are rather sceptical about its connotations. Hence, it may not be so much the contents of the (western) concept that are addressed and discussed, but rather the semantics of its Arabic translation. The statements nevertheless reflect a distinct understanding of modernity. From this perspective, agricultural activities (*nišât ziraÓáya)* do not (any longer) befit the image of “modern” Cairo. This, of course, raises fundamental questions about the policies and implications of concepts that are invented by the international development community (Escobar 1995),[30] and also about the role of local (technocratic) planning. However, in contrast to the discourse about environment, the scientific rhetoric about urban agriculture is not (yet) a local issue in Cairo.

4.3 Urban planning and restructuring

Urban planning is also related to the image of Cairo in general. The Capital provides a model for Egypt and it is from this perspective that it should present itself not only to Egyptians but also to foreign communities. In fact, the economic situation of the country depends not the least on Cairo’s image, for example, via the sensitive tourist industry. In recent years, the urban restructuring of Greater Cairo and the related vision for a “modern” city are based on a technocratic approach as reflected in the Homogeneous Sector concept. The goal is:

> *to encourage and channel [the] process of urban de-concentration and to organise the Greater Cairo agglomeration and its extensions into a number of manageable urban sub-units* (GOPP & IAURIF 1986).

In Cairo, this is expressed in the recent "face-lifting" activities in the inner city and includes the sanctioning of informal activities, e.g. at the beginning of the 1990s, (informal) booksellers in *al-Azbakáya* and people selling clothes in *ÓAtaba* were removed.[31] Also included is the "upgrading" of inner-city slum areas, such as in *BãlÂq* or in *Sayyida Zainab*, and the planned relocation of the tourist infrastructure, such as the envisioned move of the Egyptian Museum to Giza. The removal of a garbage-collecting community in Manšât Nâœir in the east of Central Cairo is planned. *Manšat Nâœir* hosts one of the biggest garbage-collecting communities in Cairo, where people make their living by recycling the waste and rearing pigs.

Mustafa Mazoun, director of the local administration of the *Manšat NÞœir* District, underlines:

> *The Governor of Cairo has given strict instructions that all animal sheds be moved from Muqaóóam to [the desert area of] Qaóóamáa, 30 km outside of Cairo, by 1 January 1999. Muqaóóam is in the heart of the capital and it can't be used as a garbage dump. It's not healthy. Besides, it's very unhygienic for people to live with animals. The decision is the best for everyone.*

Many of the garbage collectors believe the decision to relocate their activities was taken after the owners of "villas" and middle-class residents complained about living close to animal sheds and the burning of rubbish. The collectors argue that they established their community at least 20 years ago when there was nothing in the area and therefore should not be moved just to please more powerful residents.

Sharif Mahmoud, a garbage collector, believes that the government also overlooked an important issue, and asks:

> *How can the animals survive in the middle of the desert? We can manage without electricity and other infrastructure, but our pigs need water.*

The need for urban restructuring of a growing metropolis in general is not doubted; however, the particularities of related policy measures are questioned. In the past, spatial transformations have often been based on technocratic planning and on large-scale projects that do not automatically solve social problems at the local level, but too often render them simply invisible for a certain (tourist) clientele (Kuppinger 1995).

5. Perspectives for urban agriculture in Cairo

The prospects of urban agriculture in Greater Cairo are constrained by its morphological pattern (i.e., the extreme housing density), the structure of private animal husbandry (small-scale subsistence production) and vested interests in Cairo's image production. Within Egypt, Cairo must be classified as a politically sensitive area: the city has a showcase function in Egypt, and is simultaneously characterised by highly unequal living conditions. Recently, the macroeconomic liberalisation has further transformed the relationship between society and space, exposing particularly the urban low-income groups to new risks. Alongside the privatisation of state-owned companies and the entailing mass redundancies, the crucial issue for the poor has been the cut in subsidies, most importantly for foodstuffs. In this context, urban food (subsistence) production takes on a new meaning.

For one section of the urban poor, small-scale animal husbandry is of crucial importance, as it renders (affordable) meat for consumption. This group can be delineated, to simplify matters, by those having access to - more or less suitable - spaces, possessing the necessary skills, and in the position to command over some means of investment. Animal husbandry, therefore, does not take place in isolation from the wider economy, but is rather, embedded and intertwined in a variety of ways within the local community and broader development processes. Hence, the images associated with urban agriculture and animal husbandry are also constraining its potentials. The prospects of animal husbandry are thus articulated with global forces, but contested and negotiated at the local level and, so far, widely ignored at the official level.

What remains to be suggested for the future? It clearly emerges from the present argument that animal husbandry is one important strategy to cope with food insecurity in Cairo. With on-going economic privatisation at the national level and in view of the absence of a comprehensive system of social security, the focus on the local situation provides the starting-point for possible answers. Local actions, both on the household and on the community level, have long been dealing successfully with structurally imposed problems. Why not reverse things and let the local logic impose on the structure?

1 LE = ca. US$ 0.20, July 1995

2 Concerning Egypt's wheat dependency and the role of transnational corporations, see Gertel (1998).

3 Sugar and sweets supplied 7.9% of energy requirements, edible oil ca. 4.5%, fruit almost 4%, vegetables and milk products about 3% each; in addition, legumes, eggs, fish and milk made up a total of a little over 5%; see IFPRI (1994).

4 The last official price increase of the most common bread, the baladá, occurred in 1989 (from 2 to 5 piasters per loaf). However, the real price still increased after 1989; the extraction rate for flour was increased in 1990 (resulting in a lower quality), and the weight of a loaf of bread was reduced in 1991 (cf. Gertel 1998).

5 About 90% of Cairo's inhabitants had access to ration-card items in the 1980s but, since 1995, only oil and sugar are cheaper on the ration card than on the free market. In February 1995, per person and per month, half a liter of oil could be purchased for LE 0.5 on the card (the free market price per liter was LE 3.35), and one kg of sugar could be bought for LE 0.5 (the free market price of sugar was LE 1.7). Tea was also on the ration card with an allowance of 37 grams per person per month at a price of LE 0.4. The quality of tea, however, was considered very poor and, on the free market, a much better quality was available for only LE 0.08 more (50 grams for LE 0.65). The price of rice (LE 1.2 per kg), too, was sometimes cheaper on the free market (cf. Ali & Adams 1996).

6 Concerning the related reproduction crisis of low-income households in Cairo, see e.g. Tekce et al. (1994) on child health, Azer and Afifi (1992) on social support systems for the aged, and Gertel (1995) on food security.

7 The demand for clover is based on the feed required for animals used in the transport sector. Raising donkeys and horses, e.g. to pull wooden carts, is still a common practice in the densely-populated districts of Cairo, in spite of government actions against this means of transport.

8 All the following interviews were carried out by Said Samir in January 1999.

9 Cf. Gertel 1997; data are based on research jointly undertaken by the Institute of Cultural Geography, Freiburg University, and the Institute of Agro-Economics, Cairo University, in 1995 (cf. footnote 14).

10 There is little official interest in fishing as a source of urban food production. However, it is noteworthy that fishing in the Nile and in canals like the Ismailiya Canal is a "traditional" occupation for a few inhabitants of the city, who have inherited the profession over generations. These fishermen are licensed and controlled by the river police. Usually they sell fish in nearby markets close to the river. In general, the amount caught is rather small. The fish supply in Cairo depends to a very large extent on the wholesale fish market, located in Al-Ubãr, where fish - from the Mediterranean, the Red Sea and Nile fish farms - is sold on a large-scale commercial basis.

11 The figures in Tables 2 to 5 are not representative; at best, they indicate a trend: because of the scope of the described research (vulnerability and food insecurity), the households were not selected on a (completely) random basis. In order to be independent from official census data, which do not include people in informal housing areas, a spatial approach was chosen. Three areas with a low-income population (Gamâliya,Rawd al-Fara and

Maóaráya) were selected for their differences in location and age; for purposes of comparison, one ”modern” district (Muhandisán) with a section of well-to-do households was also chosen. Within each area, 4 housing types were then distinguished (private housing, public housing, informal settlements, old rural constructions) which can be used to indicate different resource structures available to the respective households. Within each of these 14 areas (4 x 4 = 16, 2 districts have no rural constructions), approximately 50 households (n=704) were selected on a random basis.

12 The number of buffaloes, horses, sheep and goats is very small and the results should be interpreted with great caution.

13 Compare types A and B: (Type A) = households with animals: nuclear households (68.1%), followed by female-headed households (17.7%) and extended families (9.7%), the remaining 4.5% is almost equally distributed between couples, male-headed households and households that do not belong to one of the other categories. (Type B) = households that do not raise animals: nuclear households (59.4%), female-headed households (18.6%) and extended families (16.6%). The remaining households (5.4%) show a similar distribution as for the rest group of households with animals (n for total sample households = 704).

14 Households raising animals have on average 2.4 rooms, whereas other households only have 2.0 rooms.

15 The poultry he sells to the retail shops originates from outside Cairo; it comes in on a daily basis.

16 Holy fasting month for Muslims. Paradoxically, food consumption increases considerably during that time.

17 In the 1980s, Environmental Quality International, a consulting firm based in New York with an office in Cairo, conducted a series of studies on the Zabbalán. These studies have not been published, see therefore Haynes & Hakim (1979), Meyer (1987) and Kamel (1994). For the history of development intervention in the Zabbalán community - ranging from Soeur Emanuelle and World Bank (IDA) to Oxfam - see Fahmi (1987).

18 The Zabbalán have to buy the right to collect the domestic garbage in Cairo from another group (the WÞháya - the people from the oasis, i.e. the Western Desert), who were garbage collectors until the 1930s and who nowadays control the property rights to Cairo’s domestic waste (Meyer 1987).

19 According to Meyer, each Zabbalán family sells an average of 25 to 35 pigs annually, while Haynes & El-Hakim estimate that almost 10 tons of pigs are sold daily by the Zabbalán (1979, 104).

20 The following data are based on the household survey in Greater Cairo in 1995 (see endnote 13). The calculations concerning the sources of income comprise both labour-based income (formal and informal activities) and transfer incomes (such as pensions, migrant transfers and income from rentals) (Gertel 1997).

21 According to the Egypt Human Development Report, about 45% of the urban population lived below the poverty line in 1995/96 (cf. INP 1996, 25). The overall poverty line is calculated at 1.098 LE per person per annum, or 91,5 LE per capita per month, respectively. The report distinguishes different poverty lines in the urban sector, depending on the calculation, ranging from 58.5 LE per capita/month (Food-based Poverty

Line) to 117.4 LE per capita/month (Upper Income Poverty Line). Whereas the first poverty line reflects only the cost of the food basket per capita, the second line includes non-food items and represents the actual income situation. The household expenditure per capita is considered to be the more reliable indicator. Thus, a third poverty line, the Lower Expenditure Poverty Line, reflecting the cost of basic needs, is set at 80.7 LE per capita/month for urban areas (cf. INP 1996, 2).

22 In order to reduce statistical disturbance concerning the distribution of the values of animals, 9 cases were excluded from the table. In 3 cases the respondents did not give any value, and in 6 cases the value given was over 1,000 LE; indicating that these households possess expensive animals such as horses or buffaloes. Of the latter, 5 cases are located in periurban areas (Maóaráya), 4 in the rural setting of Maóaráya (the value of animals ranges between 3,060-10,300 LE) and 1 in an informal housing area (2,540 LE). Only one case was found in the rural setting within the "modern" high-income area (Muhandisán), (1,660 LE). Note that the average income category relates only to households that raise animals (cf. footnote 24).

23 "Cairo Today" emphasises that the inhabitants of Cairo are threatened by dangerous levels of air pollution; quoting from a governmental study, it states: "the amount of smoke in the air has increased by 15 to 25 percent over the past five years, the amount of dust (natural and industrial) is more than 10 times over maximum safety levels, and the amount of lead in commercial areas is twice that of maximum safety levels" (Cairo Today, No. 116, October 1992). Already in 1984, Cairo residents who did not live close to heavy traffic had an average level of 30.5 micrograms lead per 100 cm3 blood. The upper limit in the EU is 35 mcc. People who are particularly exposed to air pollution – such as policemen - had a level of lead up to 63 mcc to above 80 micrograms (Cairo Today, No. 118, October 1992).

24 An industrial district in Greater Cairo.

25 Concerning Tables 5 and 6, it is not clearly indicated when the data were gathered ("during late 70's and early 80's"; El-Fouly 1992, 61) and it is also not clear who was responsible for the soil survey. Therefore, the reliability of the information cannot be assessed.

26 Zakaria Mantawy, head of local council in Maóaráya (ma,lis al mahallá) is in charge of approving cooperation with the district administration (al-hayy) on all economic activities taking place within Maóaráya.

27 Since 1972, Egypt has ratified 34 conventions relating to the environment and has taken part in almost all major environmental conferences of the region (Gomaa 1997). With the inception of the Egyptian Environmental Affairs Agency (EEAA) in 1982, the initiation of the National Environmental Action Plan in 1992, and the formulation and enactment of the Environmental Protection Law in 1994, public activity is remarkable. The Egyptian Green Party was established in 1987 and became legally recognised in 1990. In the mid-1990s, 62 environmentally-oriented NGOs were counted in Egypt, about 85% based in Cairo (Gomaa 1997).

28 For example, Maryland in Heliopolis, Orman Gardens and the Zoo in Giza, the "Aquarium" in Zamalik, and the International Park in Madánat Nâsir. High-density, low-income districts - where residential buildings are stacked next to each other with very narrow dusty lanes - lack public parks and clean open areas. Such districts are not part of official development priorities. One of the factors limiting the possibilities to increase the

green spaces and public gardens within the city is the scarcity of state-owned land inside Cairo. A recent report of the Central Accounting Agency stated that 60,746 citizens illegally occupy 950 faddân of state-owned land in Greater Cairo (Saied Ali 1998: Mafia of state-land, Al-Ahram newspaper, No. 40888, 17 Nov. 1998). Egyptian authorities are also alerted by the loss of agricultural land and are trying to preserve what is left. The "Military Order"No. 1 for 1996 prohibited transforming agricultural land into housing land, with a maximum penalty of 3 years' imprisonment and confiscation of the land. This order, however, excludes land that is located inside cities. Therefore, valuable agricultural land within Greater Cairo can still be illegally transformed and used for housing, paradoxically protected or at least not actively hindered by existing legislature.

29 All the following interviews were carried out by Said Samir in January 1999. The interviews with Prof. Abu al-Rus, and with Prof. Abd al-Ati were by telephone.

30 For example, who identifies social phenomena and defines the categories of "development" problems? Are "food insecurity" or "urban animal husbandry" perceived as such by the groups in question? What kind of vested interests are found in the respective development discourses, and who is ultimately benefiting from "development" projects?

31 In 1998, the booksellers moved back to their original location. Through a media campaign, some intellectuals have been able to convince the authorities that the booksellers do not pose a threat to the image of a modern city but rather add to the attraction of Cairo.

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MARKET-ORIENTED URBAN AGRICULTURAL PRODUCTION IN DAKAR

Alain Mbaye and Paule Moustier

1. Introduction

Occupying the Sahelian area of the tropical zone in a wide coastal strip (500 km along the Atlantic Ocean), Senegal covers some 196,192 km^2 of gently undulating land. The climate is subtropical, with two seasons: the dry season lasting 9 months, from September to July, and the wet season from July to September.

The Senegalese GNP (Gross National Product) of $570 per capita is above average for sub-Saharan Africa ($490). However, the economy is fragile and natural resources are limited. Services represent 60% of the GNP, and the rest is divided among agriculture and industry (World Bank 1996).

In 1995, the total population of Senegal rose above 8,300,000 inhabitants. The urbanisation rate stands at 40%. Dakar represents half of the urban population of the region, and more than 20% of the total population. The other main cities are much smaller (Thiès: pop. 231,000; Kaolack: pop. 200000; St. Louis: pop. 160,000).

Table 1: ***Basic facts about Senegal and Dakar***

	Senegal	Dakar (Urban Community)
Area	196,192 km^2	550 km^2
Population (1995)	8,300,000	1,940,000
Growth rate	2,9%	4%

Source: DPS 1995.

The choice of Dakar as Senegal's capital was due to its strategic location for marine shipping and its vicinity to a fertile agricultural region, the Niayes, so called for its stretches of fertile soil (*Niayes)*, between parallel sand dunes. Since colonial times, the development of infrastructure and economic activity has been concentrated in Dakar and its surroundings. Today, Dakar encompasses nearly 80% of all industry and 85% of enterprises, in less than 0.5% of national territory. With a population of 1,939,639 in 1995, it is the most densely populated city in the country (DPS 1995). The 4% population growth rate in Dakar is higher than the national average of 2.9%. Within 25 years, the population has more than doubled.

According to various sources cited in Seck et al. (1997), the population of Dakar will reach 4,500,000 by 2015. Another important factor is the extreme youth of the population (more than 55% of the population is younger than 20 years).

In 1988, more than 405,000 economically active people (persons 10 years and older) lived in Dakar, of whom more than 25% were unemployed (DPS 1992)[1] This group consists mainly of men (more than 310,000, over 75%). A more detailed analysis shows that the job market is dominated by a mixture of salaried employment (42%), independent work (30%) and apprenticeships (15%); these three categories primarily involve the youngest section of the population (Seck et al. 1997).

The term “City of Dakar” in this study stands for the Urban Community of Dakar (CUD in French). Since 1990, the CUD comprises the township of Dakar (equivalent to the Department of Dakar), the townships of Pikine and Guédiawaye (forming the Department of Pikine), as well as the townships of Rufisque and Bargny (part of the Department of Rufisque, which also includes the rural communities of Sebikotane and Sangalcam). The three departments comprise the Dakar region, which is located in the Niayes zone.

2. Dakar's different urban agricultural production systems

Since colonial times, Dakar has maintained close ties with its agricultural hinterland, the Niayes zone, for its food supply. Urban agriculture as discussed in the present document includes agriculture practised in the interior of the city (inner urban agriculture) and agriculture in the surrounding area (periurban agriculture). It is always difficult to define the pertinent limits for urban agriculture. The definition used in this paper emphasises the degree of influence exercised by the city concerning the market and urban resources. Urban agriculture is defined as agriculture located inside and around the city for which there is an alternative in the use of resources - one agricultural and the other non-agricultural. This alternative generates competition but also possible complementarity between different possible uses (Moustier & Mbaye 1998):

- building areas / agricultural ground;
- water destined for urban needs / water for irrigation;
- non-agricultural labour / agricultural labour;
- household and industrial waste / agricultural resources; and

a combination of agricultural and urban activities which generate negative side effects (theft, environmental pollution) and positive ones (green spaces).

Productions agricoles, infrastructures et ressources

Family type periurban market gardening (Picture Alain Mbaye).

Market gardening near a slum in Dakar using recycled waste (Picture Alain Mbaye).

We consider the Dakar region to be subject to these characteristics of competition and complementarity, which apply within a maximum range of 50 km around Dakar city limits.

Crop production, in particular the cultivation of vegetables, is most often realised in dune sites and basins, which can be classified into three types (Mbaye 1998):
small basins of sand, which dot the coastal range of dunes or *dioukis*;
depressions between dunes, slightly damp; and
the *Niayes* with their often peaty beds in the black greenstone soil, which resemble the sheltered places where sand has not reached, and which are made arable by a slight layer of groundwater.

The Niayes zone benefits from excellent conditions for cultivating vegetables: the influence of the cold current from the Canaries, mild average temperatures, light soil and good drainage. The area is subject to strong pressure on land. The colonisation of the habitable areas was effected according to the physical characteristics of the individual locations. The preservation of space for agricultural use was not the primary concern of the authorities; they faced the urgent necessity of quickly finding sufficient housing for a large group of people.

2.1 Main production systems

The socio-economic profiles of the cultivators vary widely: amateur gardeners, young school drop-outs looking for a stable source of employment, multi-active entrepreneurs, and so on. The survey conducted by Niang in 1993 among 300 farmers in Cambérène, Pikine and Ouakom indicates an equal division between the different socio-economic classes, aged 20 to 55 years. More than 50% of the farmers originate from urban areas (Dakar or Thiès): farming is not dominated by people from rural areas or by foreigners, but by the urban population for the purpose of generating income (Niang 1998).

The farms differ in size and type of products mainly corresponding to a rather broad spectrum of ages, levels of education and access to extra-agricultural sources of income. Agricultural production, both in and around the city, is dominated by market gardening and poultry keeping in family farms. It is estimated that these two types of farms represent more than 70% of the agricultural activity in and around Dakar. The most important production systems fall into the following categories:

- family periurban vegetable production systems (approximately 3500 farms);
- commercial periurban vegetable production systems (1000-1200 farms);
- specialised systems of poultry farming (approximately 340 farms);
- periurban systems of combined agriculture and poultry production (100-200 farms); and
- backyard horticulture and livestock systems (200-250 units).

2.1.i Family periurban vegetable production systems

These farms are often located at the periphery of the city, in the Departments of Pikine and Rufisque. Generally, the farmland is not owned by the cultivators; they rent or lease it from landowners or rural communities. The areas cover about 0.1 to 1 ha and some 3500 operations (MEACC 1996).

The vegetables are principally produced for sale, and provide most of the producer family's income. The average family size varies from 10 to 12 people, of whom three or four work on the farm. One or two non-family employees also work in the operation. The fact that these activities occupy a primary place in the family income means that farmers aim at producing throughout the year. This type of farm contributes more than 70% of the local market supply of vegetables (ISRA 1997).

The farms produce a variety of vegetables; each kind is generally cultivated in a separate plot. The main crops are tomatoes, onions, cabbage, potatoes and watermelons. Leafy vegetables, such as *bissap* (Hibiscus), with its short cycle and quick yield, and *jaxatu* (*Solanum aethicopicum*), play an important role in the smaller farms (less than 0.5 ha) and their production is without doubt underestimated by the available statistics.

Irrigation is practised, either by capturing surface groundwater from pits 2-5 m deep called *céanes*, which provide water for 8-9 months of the year, or by means of subscription to the water distribution network of Senegal Water Company (SDE - formerly SONEES, but recently privatised).

The farmers use seed, fertiliser and phytosanitary products; the latter are generally imported. These inputs are delivered in small quantities close to the production area. Facing a characteristic environment of sandy and nutrient-poor soil, the growers of the small agricultural plots of the Niayes became aware of the importance of using organic matter very early on. Equipment is limited to watering cans, rudimentary farming implements, equipment for phytosanitary treatment and, in some rare instances, a small generator-run surface irrigator.

The productivity is indicated in Table 2, in which the figures represent the spectrum of agricultural farms in the Dakar region. Factors explaining yield variability are numerous, but rainfall during the cultivation period is especially significant.

Table 2: ***Distribution of yield from market farming in the Dakar region***

Crop	Production
Potatoes	20-30 t/ha
Tomatoes	20-80 t/ha
Green beans	6-12 t/ha
Onions	20-60 t/ha
Cabbages	10-80 t/ha

Source: MEACC 1998.

2.1.ii Commercial periurban vegetable production systems

These systems are also situated in the Departments of Pikine and Rufisque, between 15 and 30 km from the centre of Dakar. Since the National Land Act of 1964 permitted private developers to buy land from ordinary landowners, farms of 1-20 ha and more have developed. They now number between 1,000 and 1,500 units, and can be classified by size: 65% have 2-5 ha, 22% have 5-10 ha and 13% are larger than 10 ha (MEACC 1998). Some of these farms have combined and now form “joint economic interest organisations” (GIE), which enjoy certain advantages, particularly in terms of access to credit.

The land is mainly farmed by paid labourers. There are on average six permanent employees per farm. Production is aimed at the domestic market and exports. The individual farmers generally have other sources of income (trade, building industry, civil service, etc.). The main crops on these farms are green beans (for export), potatoes, tomatoes, onions, cabbages, okra, *jaxatu* and eggplants. The farmers plant two or three successive crops per year. Part of the land is sown with a winter crop, either groundnuts or grain, in order to improve the condition of the soil. Some farms cultivate fruits (citrus fruits, mangos, papayas) on irrigated land. The farms have modern crop irrigation at their disposal, using drills and generator-run pumps. The greater part of the cultivation is automated. The diesel generator-run pumps and sprinkler systems represent a high level of investment, usually between 3 and 10 million FCFA.

2.1.iii Specialised systems of poultry farming

These 250 operations are located in periurban areas. They are owned by the farmer and managed by hired employees (Arbelot et al. 1997). The products are entirely destined for sale. This category includes an important number of people from the civil service and the private sector, for whom poultry farming represents a supplementary income. However, what has also happened is that 85 farmers (during their active life or after retirement) have abandoned their principal activities and focused full-time on poultry farming. The products include both broilers and laying hens (on average 4000 broilers and 2000 laying hens per year).

The buildings involved in this activity are reasonably large in size (700-1400 m^2) but, as is the case for the entire livestock industry in Dakar, the equipment (feeding and watering troughs) is obsolete and health guidelines are not closely followed.

2.1.iv Periurban systems of combined agriculture and poultry production

These farms are located in periurban areas, and the land is owned by the farmer. The products are entirely destined for sale, and the revenue complements salaried activities in both the public and the private sectors (Arbelot et al. 1997). The combined agricultural and poultry operations raise broilers (an annual average of 4000) more often than laying hens (an annual average of 800), and the buildings used for production have an average size of around 150 m^2. Poultry production in these operations is generally combined with gardening and fruit production.

2.1.v Backyard horticulture and livestock systems

Urban gardens are being developed in the city's districts as a result of initiatives by the inhabitants who collect and recycle household refuse. Many of the locations under cultivation were previously used as garbage dumps.

The courtyards of houses are often used for small poultry and cattle farming. According to Arbelot et al. (1997), there were approximately 150 small urban livestock farms in 1984. The urban livestock farms are located at the owners' homes, in buildings with limited space (about 50 m^2) and under the direct management of the owner. Production is centred around selling broilers during religious feasts; on average, 1000 broilers are produced annually. Such owners are largely young people (under 30 years) who gain a seasonal income from these activities.

There are also small fruit orchards, which generally produce heterogeneous kinds and varieties of fruits; their numbers have not as yet been determined. Such orchards are generally located close to the homes or bordering depressions, and are often very poorly kept.

2.1.vi Other types of production

There are also other types of less significant agricultural production:
privately managed fruit farms, exploited indirectly by urban investors;

dairy and sheep farms, generally extensive;
ornamental horticulture farms, primarily located in the Cambérène area; and
rainfed agriculture producing grains (millet, sorghum and maize), leguminous crops (groundnuts, *niébé* beans) and cassava, and mainly practised between July and September by the inhabitants of the rural communities of Rufisque.

3. Impact analysis

3.1 Contribution to urban household food supply

The contribution of urban production to the food supply of Dakar is substantial in the case of vegetables and poultry. Urban agriculture cannot satisfy urban needs for dry products like grains and tubers, which represent more than 30% of food consumption. However, unlike fresh vegetables and livestock, these can easily be stored and transported from rural production areas without major losses.

The proximity of Dakar, the major centre of consumption, forms a determining factor in the development of the vegetable and poultry sector. To determine the precise contribution to meeting Dakar's requirements would entail detailed comparative surveys of the origins of the products, their quantities on the urban market and the quantities consumed by the producers. Such data are not available at present. However, the relative importance in tonnage in the Dakar region compared to national production has been estimated and serves as an approximate indication of the minimum contribution to urban demand. This is based on the assumption that most of the tonnage in this region flows into Dakar’s markets, and that Dakar takes in 40% of the total demand for vegetables (Seck et al. 1997). Based on *Direction de l’Horticulture* statistics, national vegetable production during the season 1994/1995 was 154,000 tonnes, of which 4,500 tonnes were exported. In the same season, 13,000 tonnes were imported. Therefore, national vegetable consumption was 162,500 tonnes, of which the city of Dakar consumed 65,000 tonnes. The Dakar region produced approximately 40,000 tonnes of vegetables in that season, not including green beans and melons for export. The Dakar region therefore covered more than 60% of its own vegetable consumption.

Dakar poultry farming represents nearly 33% of total national production and meets 65-70% of the national demand for chickens; private societies collect the chickens, store them near the production areas and distribute them to poultry farmers (ISRA 1997).

Proceeding from the information in the ECAM household food consumption survey (1997), we can estimate that suburban vegetable and poultry production represents 12% and 7%, respectively, of Dakar food consumption. Suburban agriculture would therefore represent around 10% of total food consumption of Dakar.

It is interesting to note that suburban production supplies not only enough to meet the dietary needs of Dakar but, in conjunction with Niayes region farming, there is a surplus of poultry production which can be sold for export.
It is also important to look at the contribution of urban agriculture to future food security. Indeed, the Dakar food situation has deteriorated over the last ten years. Per capital meat consumption has dropped from 20 kg in 1993 to 11 kg in 1997, while milk consumption has dropped from 30 to 27 litres per person. The number of imported products, such as potatoes, milk products and poultry, is increasing. At the same time, suburban agriculture is declining as a result of the expansion of built-up areas and the lack of respect for the non-construction zone. The area available for grain production dropped by 29% from 1980 to 1994, and the area for fruits and vegetables went down by 6%. The supply zones for Dakar are increasingly located away from the city, and the costs of transport represent more than half of the selling price (Seck et al. 1997, Seck & Moustier 1998). From a food-security point of view, it therefore seems advisable to increase the contribution that urban agriculture makes to providing food for Dakar.

3.2 Health

Agricultural production taking place in an urban environment creates certain household health threats. For example, many wet-season production sites located in the poor quarters are adjacent to industrial areas and main roads.

Very high concentrations of nitrates (in the order of 200-500 mg/l) and bacteria originating from faecal waste have been observed in water used for irrigating agricultural plots on many production sites (Niang 1993, Valentin 1998). The water can be industrial waste, effluent or household waste. The potential consequences are very serious when the producers make direct use of non-treated domestic wastewater for irrigation.

Dakar and Pikine produce nearly 120,000 m^3 of wastewater per day, of which 50,000 m^3 are drained through the sewer network directly from households and 70,000 m^3 are filtered indirectly by means of “watertight” pits (Infoterra 1996). In reality, of the 50,000 m^3 drained into the sewers, only some 9,000 m^3 are treated in Cambérène's wastewater treatment plant before being released into the sea. Most of the rest is dumped untreated into the sea or used directly in farming. The latter is the case in the Niayes of Pikine and in the non-built-up areas of the Ouakam district, where many cultivators exclusively use wastewater from the sewer network of the city (Niang 1996). The food products from these farming systems are sold indiscriminately in all the markets of Dakar, exposing the entire population of the city to an enormous sanitary risk. Niang (1996) mentions a typhoid fever epidemic of 400 reported cases in Dakar. The epidemic was apparently caused by the consumption of vegetables from Pikine farming sites that use wastewater which is insufficiently treated or not treated at all.

3.3 Urban farming and the urban environment

Similar to 70% of the urban zones of West Africa (ENDA 1997), a lack of municipal and state funds means that many of the urban districts of Dakar do not have an adequate network for distributing drinkable water, carrying off wastewater and/or collecting household waste. In 1993, the amount of household waste was estimated at 870 tons per year (CUD 1993). Farming makes it possible to remove and partly recycle organic waste, both solid and liquid.
Organic waste is systematically used in farming. Groundnut shells, fish waste, poultry excrement, industrial waste, fertiliser, garden soil and various composted materials are transported by a chain of manual labourers. The inhabitants of the poorest districts took the initiative of collecting and recycling urban waste as part of the search for long-term solutions to cleaning up their surroundings (Niang 1996, Gaye 1996, ENDA 1997). In Diokoul and Castors, districts in the city of Rufisque, previously uninhabitable areas filled with garbage now form true urban farms in the heart of town close to well-functioning networks for removing household garbage and wastewater. Two plants for treating wastewater (macrophyte basins) and composting household garbage are located there. An integrated management system is in place through which the final products are either sold or used on the agricultural plots of the plants themselves. The recycled water is sold, stored for irrigation of agricultural plots, used for the reforestation of large abandoned stone quarries or used in making *parpaing* blocks. The compost is sold to farms and individuals.

As a result of its biophysical characteristics and the microclimate of the city, the Niayes zone, Dakar’s principal site of agricultural production, has gained the title ‘green lung’ and has even been declared a public state resource (UICN 1998) in order to preserve it. Because most of the farming areas are located in depressions and dune areas, the water is able to penetrate the soil, in contrast to the built-up areas, which are almost impermeable to water. Growing produce on the hills of non-built-up areas reduces soil erosion as a result of rainwater retention (Valentin 1998). The survival of the numerous interdunal depressions where agricultural activities are being developed depends on the fixation of the dunes. The *filao*[2] plantations between Cambérène and Guédiawaye have caused the rate of white dune-sand erosion to be reduced from 12 m to 2 m per year. The positive role the Niayes play in the urban environment is now compromised by the urbanisation of the dune areas.

3.4 Urban farming and the domestic economy

The direct creation of employment in urban agriculture has been estimated at over 15,000 jobs in the Dakar region (MEACC 1996). Informal, interdependent business networks have formed spontaneously both upstream and downstream from the urban agriculture itself. These networks help to create jobs in the crafts and service trades. Focusing specifically on the market farmers of the Santhiaba at Thiaroye-sur-mer neighbourhood, Valentin (1998) lists a variety of crafts and services which are a great source of employment and income to the people. The market gardeners make use of many metalworkers and blacksmiths to fashion small implements such as watering cans and hoes. In the services sector, vehicles are hired to haul manure, groundnut shells, fish waste, mineral fertilisers, etc. Small retailers offer various agricultural commodities packaged and adapted to the needs and budgets of small gardeners. On another level, the use of waste and garbage of all types has encouraged the emergence of a chain of crafts related to the recovery, processing and selling of such wastes. This has helped to create petty jobs that contribute directly to the supply of inputs and small farming implements for urban agriculture (Waas & Diop 1990).

In the fruits and vegetables commodity systems, farmers' wives play an important role in the marketing networks, especially in Cambérène, Thiaroye, Pikine and Yeumbeul, where petty commodity production predominates. These women set themselves up as retailers and account for 45% of traders in most of the principal markets.

The data available on prices do not reveal excessive profit margins when compared to other businesses. Seasonal price fluctuations pose more of a problem for the consumer than does the overall price level. For example, the price of cabbage fluctuated from 1989 to 1993 between a low of 84 FCFA or US$ 4.00 per kg in February to a high of 423 FCFA (US$ 21.00) in October, the month with the highest prices (ISRA/CDH data).

3.5 Urban agriculture and gender relations

From ISRA (Senegal Institute for Agricultural Research) researchers' frequent contacts with the Niayes region's horticultural and livestock farms, it appears that men are probably in charge in three out of four cases, though female family members - wife, daughter or niece - participate in the work. As with many other urban occupations in Africa, the higher the start-up costs, the more men are involved in the business (Moustier & David 1997). Thus, women are practically absent from poultry raising and ornamental horticulture. On the other hand, they are nearly as numerous as men in backyard market gardening. The Niang study (1998) shows that men accounted for 99% of the market farmers surveyed in 1993 at Cambérène and Pikine and 63% of the market farmers of Ouakam.

The Fedri group, located about 10 km from Dakar, presents an interesting case of women voluntarily investing in urban agriculture. The group consists of 9 women who combine their vegetable farming activities aimed at the domestic market (okra, tomatoes) and for export (green beans) with raising small ruminants, sheep and cattle. They even tend forest plots and fruit orchards. The group is financed by a NGO (non-governmental organisation). It is noteworthy that the women in the Fedri group are former vegetable retailers. The women market farmers and producers always play a separate role in the areas of marketing and processing agricultural products. Selling vegetables incurs low start-up costs and can serve as a good take-off point for entering farming. However, as with production, men take up the selling activities with the highest start-up costs. Over 90% of vegetable retailers in the open markets in Dakar are women, while all the shopkeepers retailing various food products, including onions, are men. Men are also involved in wholesaling onions and potatoes, because these products can be stored and the men can raise the needed, significant working capital. Storage is not needed for perishable vegetables such as greens and tomatoes, where women are in the majority both as wholesalers and as retailers.

4. Policies affecting urban agriculture

4.1 Urban agriculture and urban planning

An important aspect to note is the lack of a formal framework for joint action in the field of urban agriculture. The public authorities do not openly promote it, neither is there a written policy for its eradication or prohibition (Valentin 1998). One indication, however, is that it apparently is not a priority in urban planning policies and programmes. Small producers are most affected by this, as they realise that the lands they occupy may be recovered by the government at any time for a public purpose.

The colonisation of the Niayes region of Pikine-Cambérène and of new construction areas between Dalifort and Cambérène illustrates this threat. The urgent need to house the homeless population takes priority over maintaining, or relocating, farming areas. Problems with understanding Senegalese real-estate law, particularly the 1964 National Land Act, are that those who farm the land rely on the fact that “the land first belongs to those who cultivate it”. The first actions arising from the government’s policy of regionalisation and decentralisation, notably the transfers of jurisdiction to local and regional authorities, are now causing the latter to play a major role in the development and redistribution of land falling under their jurisdiction. In its final provisions, the National Land Act grants discretionary powers to urban community leaders to allocate land (Decupper 1995).

The fear is that the well-known lack of distribution criteria, combined with pressing urbanisation, are sounding the death knell for much of the farming around Dakar. Industrial plants already have shown a noticeable propensity to occupy rural communities, and are more likely to create jobs and significantly contribute to municipal treasuries (Tall 1999).

Run-away urban sprawl and the resulting environmental problems have led the government to develop a project in Dakar’s master urban plan for “1982-2001” (World Conservation Union 1998). This project has already resulted in a draft decree for setting aside 700-800 ha in the western and southern zones of Pikine, which should protect space for farming activities, parks and recreational areas, and sports and cultural activities. The urban plan calls for:

- stabilising dune slopes with appropriate plantings to limit the filling of dyked enclosures by sand;
- strengthening protection of oil palm and coconut formations;
- assigning land for family farms and agricultural experimental stations on land suitable for small market farms and orchards;
- using land unsuitable for farming for cultural, educational, sports and recreational purposes;
- developing deep ponds and lakes to provide drainage for the Niayes region; and
- creating new sewage treatment plants to treat wastewater to be re-used for agricultural irrigation.

However, at the present time, it appears that this plan cannot be properly implemented, because of the rapid pace at which space is being used in a way that does not conform with the plan. One example is the creation of the towns of Guédiawaye and Bargny, which occurred after the master plan studies were made. This prevented laying out the plots in question in the western and southern areas of Pikine. The World Conservation Union (1998) cited several reasons for the difficulty in setting aside the land. These include the government's inability to raise funds from expropriation loans, real-estate speculation and the high cost of land reserves. Other problems were the lack of coordination among the towns of Patte d'Oie, Dalifort and Pikine, all of which are included in this zone. The government nevertheless allocated a portion of the Niayes region to create a "science park" for technical and scientific innovation as well as sports and cultural activities.

4.2 Recent initiatives and measures encouraging urban agriculture

Cambérène's Centre for Horticultural Development (CDH) was formed in 1972 with financial support from Belgium and the Food and Agriculture Organisation of the United Nations (FAO). It is about 20 km from Dakar in the heart of a major horticultural area. The centre administratively depends on the Department dealing with Niayes region in ISRA. The CDH has spurred the fostering of a diversified and steady production of vegetables, fruits and flowers (Mbaye et al. 1998). Among the centre's achievements, we can cite the fine-tuning of growing schedules to spread vegetable production over the rainy season, fruit tree and vegetable nursery techniques, selection of varieties, and making an inventory of methods to combat crop pests and diseases. The CDH is also involved in gathering data on farm produce prices in Dakar markets.

It is difficult to assess the effect of CDH projects on the development of urban agriculture. The channels for communicating the results are numerous and diffuse (e.g. technical recommendations spread by NGOs and tours of the centre by producers). However, urban farming as a profession has not been sufficiently analysed. Although a farmers' typology exists, there is not enough information on the relative size of the various groups represented, and their technical and economic results are not monitored over time. However, the price data shows that the seasonal peak of supply prices has been reduced, thanks in large part to the action taken by the CDH. From 1990 to 1994, the multiplier for vegetables dropped from 3 to 1.9 (Seck et al. 1997).

On other fronts, measures taken to improve sanitation in several Dakar areas, particularly in terms of household garbage collection and recycling and wastewater, have indirectly resulted in further development of market gardening.

5. Perspectives for the development of urban agriculture

5.1 Constraints and threats

In its strategic plan, CDH, which focused its investigations on the Niayes region, attempted to list and analyse the principal constraints for expanding urban agriculture (ISRA 1997). The analysis was extended and supplemented by several other contributions (Mbaye et al. 1998, Mbaye 1988, Seck & Moustier 1998, Seck et al. 1997; Bastianelli et al. 1998, UICN 1998). The constraints apply to a city that has almost reached the limits of its carrying capacity, a city under extreme demographic pressure, where human settlement areas are in fierce competition with agriculture for insufficient resources that are declining even further. A study conducted on the Niayes of Pikine-Thiaroye (Ndong 1990) demonstrates how pervasive this process has become.

Urbanisation has substantial consequences for agricultural land (UICN 1998), i.e.:

- a gradual reduction in the surface of dunes and dyked areas as they give way to development;
- a reduction in water flow owing to a lesser amount of surface available for drainage of sand from dunes, and to consumption by the activities of residents;
- a reduction in biotopes and in the number of animal and plant species characteristic of the site; salinisation of agricultural land;
- pollution of the water table (by nitrates) caused by defective residential sanitation systems and intensive use of mineral fertilisers by farmers; and
- pollution by miscellaneous waste.

With regard to the farmers themselves, the constraints can be broken down into the following three major categories:

- constraints in terms of access to land and irrigation water;
- limits to efficiency posed by scarce resources (land and water) that slow down attempts to intensify production (problems accessing inputs, technical extension and agricultural credits, etc.); and
- constraints related to the valuing of production (problems of competitiveness, unstable supply and demand).

Considerable advances have been made in promoting and monitoring production through the distribution of technical advice from research and through increased follow-up and cooperation among the various sectors in the region. However, these measures have never been included adequately in an overall approach to sustainable natural resource management. Furthermore, they suffered from sector-based technical attitudes demonstrating little knowledge of the social, economic and political stakes involved in the gradual and irreversible urbanisation of agricultural space. Indeed, what alternative could be suggested to a residential development program covering 8,200 ha in the rural areas of the Rufisque-Bargny district? What choices should be made when it comes to policies for supplying drinking water and irrigation water in a city like Dakar, where the daily shortage of drinking water amounts to 100,000-162,000 m^3? How can sustainable sanitation projects be made to work in a city where waste production levels exceed the garbage collection and recycling capacity and where most of the residents live in highly precarious conditions? These are fundamental questions for which effective and lasting answers must be found if we wish to maintain urban agriculture as an asset.

5.2 Recommendations

Two major types of recommendations come to mind: those aimed at preserving the physical resources and production potential of the sites that lend themselves to urban agriculture, and those aimed at securing food supply and distribution systems. The recommendations are made in the context of recent collaborative efforts, such as cooperation on the inventory and description of the Niaye area of Dakar (UICN 1998), the sub-regional FAO/ISRA seminar on food supply and distribution systems in French-speaking Africa (Seck et al. 1997) and the recommendations by the GRS[5]. We shall conclude with a third type of recommendation: the creation of an information system on the dynamics of urban agriculture in Dakar.

5.2.i Preserving physical resources and production potential

We mentioned the plan to set aside 700-800 ha in the Niayes region and the problems encountered in implementing this project. The state must be firm in implementing this plan, and more particularly the following measures:

- preserving the dyked areas located in the areas outside the (development) site, particularly the two bodies of water included in the property of the Hann-Maristes housing construction project;
- preventing any appeals by the expropriated landowners to repeal the transferability of their land;
- extending land-use research to the dyked areas outside the development site with a view to including them in the site;
- redefining the land-use plan by updating the former development plan;
- establishing a committee to protect the site;
- not caving in to any requests for land included in the site owing to its status as a public purpose area;

- making the residents aware of the important role to be played by the site in preserving the fabric of the city;
- establishing a framework for co-operation among the various institutions involved in any way in the management or use of the site;
- stepping up production;
- eliminating or reducing the tax on major basic agricultural inputs (fertilisers, pesticides, seeds, chicks) and basic foodstuffs; projects are underway to deal with these issues, but the slow pace of implementation is causing a certain scepticism among the major potential recipients; and
- adapting the terms for loans to the socio-economic status and strategies of the players. The terms involve collateral (deemed high and difficult to obtain), interest rates, loan term (shorter than the production and marketing cycle), and procedures for extending and obtaining loans (too long and complex). They should be revised thoroughly for each category of recipient.

Production systems must be streamlined and production costs reduced. In the area of the use of water resources, steps are already being taken towards more rational management, and vital techniques and equipment are being used to save water (Mbaye et al. 1998). Surveys conducted in the market gardens in the Dakar region (MEACC 1996) show that producers prefer localised micro-irrigation systems. These systems can help to save water while at the same time contributing to substantial productivity gains and better parasite control.

5.2.ii Securing food supply and distribution systems

Emphasis must be placed on strengthening or creating effective organisations to market the products from urban agriculture both in the wholesale and in the retail markets, i.e.:

- the wholesale redistribution platforms in Dakar must be revitalised;
- credit unions must adjust to the investment capacities of producers, wholesalers and retailers; and
- fora to discuss marketing problems can lead to shared solutions and action plans aimed at concrete objectives, such as reducing seasonal losses and reducing imports.

These actions must be backed by information systems on production and marketing conditions

5.2.iii Information system on the dynamics of urban agriculture in Dakar

All the above-mentioned actions must be based on careful observation of the phenomena associated with urban agriculture by an information system to be used by private operators and policy makers. The most effective dialogue between stakeholders is one in which the players have a basis for reliable evaluation of their situation in terms of resource preservation and competitiveness of the sectors. Data on agriculture in and around cities are still fragmented from a geographical perspective, do not represent a continuous timeline and are not easily available to private stakeholders and policy-makers. Urban agriculture is a sector that involves substantial transfers of resources (e.g. land, waste and water) and traded products, and movements of farmers. The produce in question is subject to numerous hazards and is highly dependent on market demand. Therefore, it is important to have tools for measuring and observing movements of resources and products over time, with particular emphasis on the following:

- the farmers, producers, merchants and other service providers: monitoring the diversity and relative importance of the various categories in terms of strategies as well as technical, economic and social results;
- urban consumer households: monitoring the products consumed in terms of quantity, price, quality and origin;
- movements of products between consumption and production, and the place of urban agriculture in these movements in terms of quantity, price and quality;
- movements of organic matter and energy (supply and use);
- movements of water resources;
- changes in land use and location of farms;
- changes over time in the cost of resources and operating income at the various stages of the commodity systems; and
- impact of technical and institutional support on the various indicators.

A monitoring body should focus on gathering and analysing these data and on distributing them and discussing them regularly with private stakeholders and policy-makers. This organisation would form the basis for stakeholders' dialogue, which is vital to reduce competition and enhance complementarity in accessing resources and urban markets (Seck & Moustier 1998).

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1 The analysis of economic activity in the Senegalese context is very complex (DPS 1992). Children typically carry out productive activities, and women are often involved outside the home in the production of goods and services, especially in the informal sector.

2 The *filao* (*Casuarina equisetifolia*) is a plant originating in the coastal area of Southeast Asia, currently used for enriching sandy, poor soils.

3 GRS was created by a decree of the Senegal Ministry of Agriculture in July 1996. Its mandate was to formulate expert opinions and recommendations on: (i) options in terms of long-term agricultural policies consistent with the other objectives of the ministry and rational natural resources management; (ii) oays and means to reconcile approaches and concerns of agricultural producers within the objectives and constraints of the State; and (iii) preparation of programs and investment projects in the agricultural sector.

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URBAN AGRICULTURE IN DAR ES SALAAM: PROVIDING AN INDISPENSABLE PART OF THE DIET

Petra Jacobi, Jörg Amend and Suzan Kiango

1. Introduction

Dar es Salaam is by far the most important urban centre in Tanzania. With rapid urban growth in the last two decades, this city now accounts for about 35% of the total urban population of Tanzania (Burra 1997, CHS 1995). It is seven times larger than the country's next urban centre, Mwanza. It is the main destination in rural-urban migration, which the country has witnessed since its political independence in 1961 (Oyieke, Nnkya & Kofi Doe 1997). Rural-urban migration and natural growth equally share the increase in Dar es Salaam' s population to date (CHS 1995).

Table 1: ***Basic facts on Tanzania and Dar es Salaam***

	Tanzania	**Dar es Salaam**
Area	945,000 km²	1350 km², ca. 200 km² inner city
Population	Approx. 30 million	Approx. 3 million
Growth rate	2.8%	8%
Urbanisation	Estimated 20%	
Poverty	Ca. 50% of the total population and 60% of the rural population are below the poverty line*	

*) Ferreira 1994, Nayaran 1997.

Located 800 km south of the equator on the East African coast, Dar es Salaam was established by Sultan Seyyid Majid of Zanzibar in 1862. As a port and trading centre, the town grew rapidly, especially since the relocation of the German colonial headquarters in 1891. The Germans, later followed by the British, introduced a three-zone model to the city. Zone 1 northeast of the harbour was reserved for Europeans. Today the area is mixed but still a low-density area. The second zone around the harbour was reserved as a business zone and was later mainly inhabited by Indians. It is today's Central Business District and one of the most populated areas. Zone 3 was reserved for native quarters, rigidly planned in order to avoid further squatting (CHS 1995, Vicent 1970). The densely-populated second and third zones are considered the city centre of Dar es Salaam today.

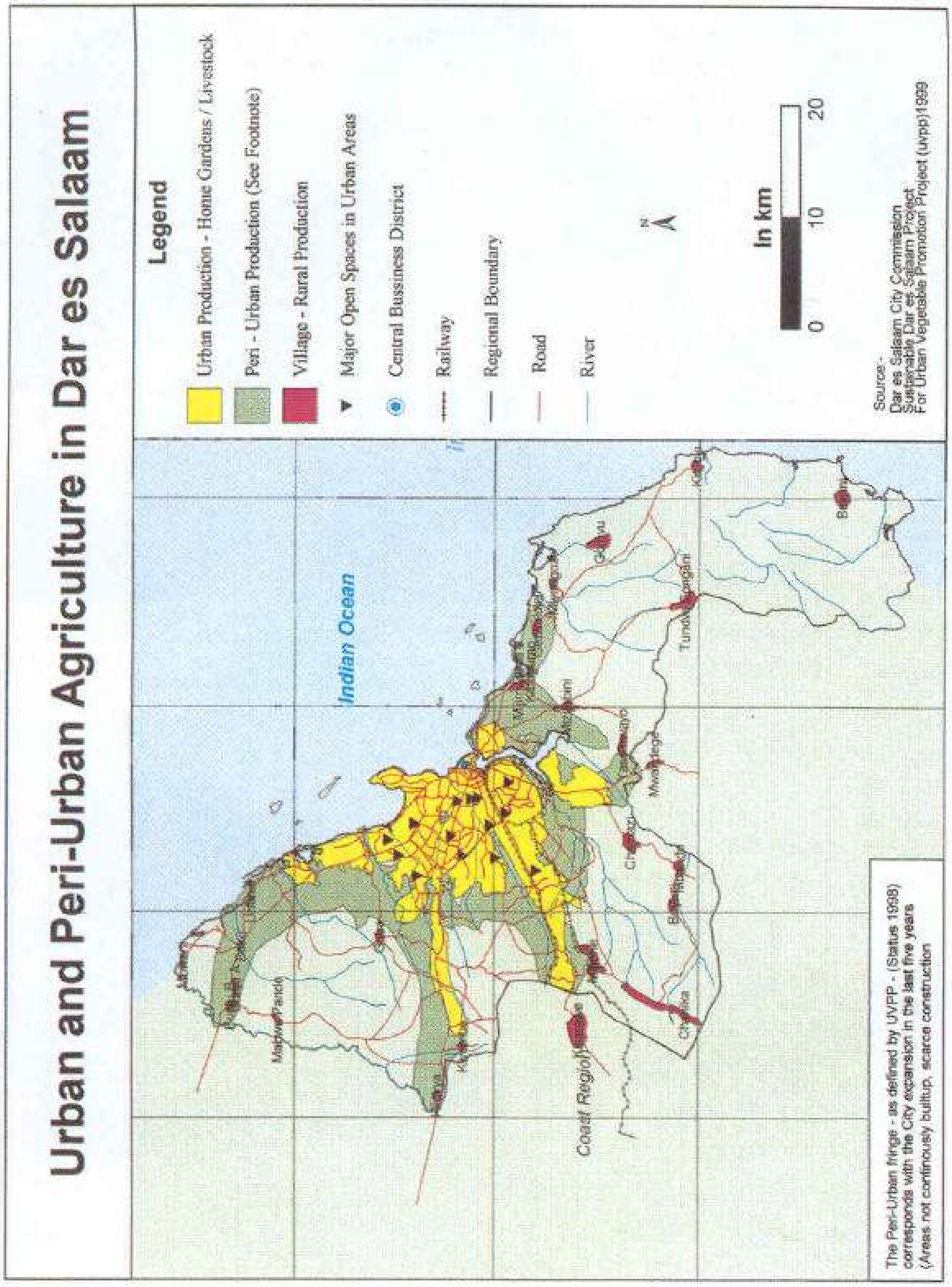
In 1948, a first Master Plan introduced general guidelines for development of the city and led to the construction of low-cost tenant houses near the city centre around the harbour. After independence in 1961, housing was in short supply because of high rural-urban migration, and squatting increased rapidly. While in the beginning attempts were made to clear the slum areas, in 1972 the government changed its policy and ordered that squatter settlements should be improved rather than demolished. In the 1978 Master Plan, squatting was accepted and the focus shifted to uplifting these areas (CHS 1995). To date, about 70% of the population live in unplanned settlements with marginal access to tap water, sewage systems, infrastructure or basic social services (SDP 1992, United Republic of Tanzania 1996).

Formal employment is decreasing, and informal activities have become a necessary strategy for survival (Mascarenhas 1994;17, United Republic of Tanzania 1996). According to a study by the Planning Commission and the Ministry of Labour and Youth Development (1995), about 30% of the urban population gains an income in the informal sector and about 6.5% of the informal urban workforce works in urban agriculture, not taking into account the huge number of subsistence home gardeners in the city.

2. Types of urban agriculture

Dar es Salaams’ coastal plain and climate (with 1000 mm annually in wet seasons from March to May and from October to December) do not offer very favourable conditions for intensive agriculture (Sawio 1998). Nevertheless, urban agriculture is widely practised (Jacobi 1997, Jacobi & Amend 1997, Mvena et al. 1991). Urban agriculture is a direct response to local needs and favoured by a still fairly low-density urban pattern and open areas available in town.

A large number of cultivators in the open spaces acquired their plots during the economic crisis in the first half of the 1970s, when the government encouraged people in the city to cultivate every available piece of land. Following a decline in farming in the latter half of the 1970s, it has increased again in recent years (Stevenson et al. 1994).


Urban and Peri-Urban Agriculture in Dar es Salaam
Legend
Urban Production - Home Gardens / Livestock
Peri - Urban Production (See Footnote)
Village - Rural Production
Major Open Spaces in Urban Areas
Central Bussiness District
Railway
Regional Boundary
Road
River
In km
0
10
20
Source -
Dar es Salaam City Commission
Sustainable Dar es Salaam Project
For Urban Vegetable Promotion Project (uvpp)1999
Indian Ocean
Coast Region
The Peri-Urban fringe - as defined by UVPP - (Status 1998)
corresponds with the City expansion in the last five years
(Areas not continously builtup, scarce construction

Home gardening in a high density areas of Dar es Salaam (Picture Urban Vegetable Promotion Project)

Cattle raising in Dar es Salaam's urban area (Picture Urban Vegetable Promotion Project)

Box 1: ***Definition of Dar es Salaam's urban farming***

Intraurban production:
Any agricultural activity which takes place in the continuously built-up residential, institutional or industrial areas in the city.

Periurban production
Any agricultural activity which takes place at the fringes of the continuously built-up areas. The periurban area has scattered homesteads, but is not as dense as the urban area. A change from rural to urban activities can be observed. The periurban area acts as a corridor between the urban and rural areas.

Both private and public land, residential plots and industrial or institutional areas are under cultivation. Use of private property needs either a formal (title, rent agreement) or an informal agreement (producer negotiates with the owner and obtains permission to cultivate, with no written contract). In most cases, public land is used without agreement and illegally encroached. A considerable amount is produced in open spaces without secure land rights.

Water is scarce in the dry season, as the public water-supply system can hardly keep up with the requirements of the increasing population. Access to a reliable source of water, which varies tremendously between wards, determines the potential of the agricultural enterprise. Where there is no water supply, farmers produce under rainfed conditions. Commercial production is carried out in locations with enough surface water for continuous production (rivers, open drains), as systems depending on tap water or shallow wells produce at a risk. Supply of drinking water is guaranteed through local water sellers, but purchasing water for irrigation or collecting it from distant sources is not economic.

In the inner town, vegetable production is the most common production system, followed by dairy and poultry keeping. In the periurban fringes, a mixed crop-livestock system, fairly rural in character, is often found. Here, fruit and nuts are also produced. Rooftop gardening, aquaculture and container gardening are promoted, but these "advanced" production techniques are not widely accepted.

Food production in urban areas has two clear objectives. It generates income and reduces costs. In previous studies[1], it became clear that the urban farmers form a complex mix of social groups. Stevenson et al. (1994) showed that urban farmers are rarely recent migrants. Urban farmers have been living in town for 10-15 years, which suggests that access to resources can be obtained only if a resident is well embedded in the social system. Nevertheless, food production is often a

1 Jacobi 1997, Mlozi 1998, Sawio 1994, Stevenson et al. 1994

recent activity to many residents. About half of the farmers started practising agriculture in the last five years (Mlozi 1998). This is related to the declining purchasing power and the absence of formal employment. Urban food production is often a necessary supplement to the household's food supply or budget (Mascarenhas 1995, UNDP 1996).

Farming is not restricted to certain age groups. Farm families are generally bigger than the average Dar es Salaam household (5-7 compared to 4-5 members). Larger households have a higher demand for family income and are thus using their resources to produce more of their own food (Stevenson et al. 1994).

Crop cultivation is dominant in Dar es Salaam (Jacobi 1997, Tesha 1996). Leafy vegetables are in high demand, because they are part of the traditional diet. Eggplant, sweet and hot pepper, okra and tomato as well as fruits like oranges, mangoes, banana, papaya and pineapple are produced in the periurban area. With their short production cycle, vegetables can be grown in locations where water is not available throughout the year, where there is no long-term right to using the land and where little space is available. Occasionally, green maize and rice is produced in the inner city during the long rainy season; otherwise, staples come primarily from periurban or rural areas.

Table 1: Yield potential of selected leafy vegetables and their cultivation period

Type of vegetable	Total yield/m² in one period	Cultivation period in weeks
African spinach leaves (*Amaranthus* ssp.)	1.5 kg	3-4 weeks
Chinese cabbage leaves (*Brassica chinensis*)	5 kg	10-12 weeks
Sweet potato leaves (*Ipomea batata*)	1.5 kg	12-17 weeks
Swiss chard leaves (*Beta vulgaris* var. cicla)	6 kg	15-17 weeks
Kale leaves (*Brassica oleracea* var. Acephala)	3.5 kg	15-17 weeks
Cowpea leaves (*Vigna unguiculata*)	2 kg	9-11 weeks
Pumpkin leaves (*Curcubita moschata*)	0.7 kg	11-13 weeks

Source: UVPP field data.

Few resources are necessary for urban farming, which makes it a possible choice for all households. A hoe, a bush knife (*panga*) and a watering can are required for subsistence production. In more market-oriented systems, irrigation through hoses or pipes, and knapsack sprayers for plant protection can be found. Also in the periurban areas, hardly any mechanisation or advanced irrigation systems are found.

All cultivation in town heavily depends on organic fertiliser (poultry or cattle manure). There is a well-established exchange system between poultry keepers and vegetable producers, but at times the demand is higher than the supply. In the periurban areas, also mineral fertilisers are used. Pest management ranges from zero treatment for subsistence to full treatment and even overdosage in the case of market-oriented producers. Recently, also organic practices are promoted by bilateral projects.

Cattle, goats and chickens are kept in close vicinity to urban settlements. While cattle are kept exclusively by medium- and high-income groups either in the periurban areas or in low- density settlement areas, goats and chickens are affordable to all income groups. The number depends on family income. Current cattle population in Dar es Salaam is projected at 34,000 cattle, 12,500 goats, 1,500,000 poultry and 5,000 pigs (MoAC 1999). Animal production is for the market, with only a small portion consumed in the household. Livestock rearing, especially in low-density and periurban areas, is often combined with cropping systems (Mlozi 1998, Tesha 1996). However, livestock and cropping systems are not always well integrated. This is especially true for free-ranging animals. Destruction of crops by chicken rates as the main problem of home gardeners in high-density areas and sometimes prevents cultivation.

By and large, the extension system concentrates on the rural areas. However, steps are taken to address additionally the various urban farmer groups and to develop appropriate strategies. More than 200 extensionists are currently stationed in the Dar es Salaam region, some of them with special duties in the city gardens. With the ongoing civil service reform, the number will decrease, but up to now there is a general interest to maintain the system. Because of the limited outreach of the governmental service, a private system for livestock services operates.

2.1 Home garden production

In Dar es Salaam, backyard farming is the most important type of urban farming according to the number of households involved. Gardens are found all over the city among all income groups and are cultivated with minimal inputs on an individual basis. Urban home gardens belong to a residential plot. The prevailing objective is home consumption. Home gardens are cultivated by one or more persons of the same household. The right to use the land is linked with the tenure of the house or the permission of the landlord and therefore legal. Vegetables in particular are grown.

In Dar es Salaam, water is obviously the limiting factor and many gardens are entirely rainfed. Shallow wells and tap water are equally important. In the dry seasons, tap water is unreliable and the water levels decrease; production is therefore restricted from May to October. Besides lack of water, lack of land for further expansion, lack of marketing possibilities, pest management and availability of inexpensive but good-quality inputs (seeds, fertiliser) are major problems mentioned by gardeners.

2.1.i Gardening in high-density areas

Gardening in high-density areas or unplanned settlements is mostly subsistence-oriented and a clear survival strategy for the poorer households. In two unplanned areas (both sites are about 20 ha) it was found that 15-20% of all the houses had home gardens during the growing season (Jacobi 1997). These backyard gardens cover 40-80 m² on average[2].

Women are traditionally responsible for feeding the family and also for home gardening; men hardly play a role. A variety of leaves are produced, which are used for home consumption. Here, the drought-tolerant sweet potato leaves, as well as cow pea, cassava and pumpkin leaves are found. The varieties allow continuous picking over a prolonged period of time, serving as a low but steady food supply. When household budgets are tight, vegetables produced in the own garden are often the only source of vitamins. Besides consumption, the vegetables (ca. 10%) serve social functions and are given to neighbours and relatives. Surplus is sold to nearby retail shops.

2.1.ii Low-density settlements

These areas have more favourable conditions for home gardening. The plots are bigger in size (ca. 4.000 m²) and tap water is frequently available. Mlozi (1998) found that garden sizes on house plots varied between 500-800 m² and that the bulk of production was for home consumption. Medium-income groups, especially government employees, use these resources for additional income or to cut food costs. Gardening is not restricted to a specific gender.

2 Sawio (1994) found that the most commonly cited garden size ranged from 50-100 m²; Stevenson et al. (1996) and Yachkaschi (1997) found a higher average of 270 m² for home gardens.

2.2 Livestock production in urban homesteads

In the study by Mlozi (1998) on low-density home gardens, 65% of the gardeners reported having livestock, 24% had cattle followed by 21% of poultry (broilers/layers) and 19% local fowl. The importance becomes clear by the fact that around 16% of the urban milk consumption originates from urban production (44% periurban, 28% imports, 8% Masai herds, 4% others) (Sumberg 1997). The urban system is characterised as one “which is essentially a sideline economic activity; it is characterised by small herds, feed gathered and grazed from public land or purchased from boys who cut roadside grass, and direct marketing to individual consumers” (Sumberg 1996).

Compared to the periurban areas, the growth of urban dairy cattle population has been extraordinary in the last decade. Most urban cattle keepers are government employees using government plots allocated to them to increase their salaries. Taking into account the ongoing civil service reform, it is likely that there will be a reduction of staff combined with vacation of these prime residential locations and part of the urban production might shift to the periurban areas. Also, poultry keeping - both extensive and intensive - is widespread, though on a small scale (Sumberg 1996).

2.3 Community gardens

Community gardens are found in high- and medium-density areas on public land, normally close to the producers’ homesteads. The gardens are farmed by formally or informally organised groups of people within the community, but with individual ownership. Production has a dual purpose of subsistence and income.

Mainly through efforts from outside, a number of informal "community garden groups" have developed. The fact that they are gardening as a group differentiates them from individual home gardeners or producers in open spaces. Plot sizes tend to be bigger than average home gardens. Women are more active in community gardens; however, about one third of the gardeners is male. The production is more diverse than in home gardens and open spaces. The bulk is for home consumption. Access to services (e.g. extension, inputs) is easier for these organised groups. Besides material benefits, the groups have important social functions. Most of the groups function as a security system, providing services to each other (credit and savings, contributions in times of sickness, funerals and weddings).

2.4 Open-space production

Open spaces are areas of market-oriented intraurban crop production surrounded by residential, industrial or institutional areas. The land is public (hazardous lands not suitable for construction, road reserves, available land for community use, etc.) as well as private (residential, industrial or institutional plots underutilised or awaiting development). While public land is generally farmed without official permission, use of private land depends on a formal or informal agreement with the owner. The area can vary considerably in size and ownership (Jacobi 1997, Kiango & Likoko 1996). In the urban area of Dar es Salaam nearly 650 ha of open spaces are cultivated with an average plot size of 700-950 m^2 (Dongus 2000, Stevenson et al. 1994, Yachkaschi 1997). Most of the open spaces stretch along rivers and water drains. Occasionally, shallow wells and legally or illegally tapped water are alternative water sources. Open spaces have a year-round production.

Open spaces are cultivated by more than one farmer, mainly men from low- and medium-income groups. The men do not necessarily work together as a group. Producers on one open space tend to come from the same tribe, but various tribes can be found in this business.

Production concentrates on market-oriented leafy vegetable production (*Amaranthus* ssp, Chinese cabbage) which are an essential part of the traditional diet. Leaves are very perishable and do not tolerate transport. The short distances to the consumers offers open-space producers a niche market, which cannot be taken over by producers outside the city.

The marketing system depends greatly on the location of the open space: direct sales to passers-by, sale of an entire vegetable bed to middlemen or preparing bundles of leafy vegetables for the various markets in the city. Marketing strategies vary in time depending on overall demand and supply of vegetables. After the long rains demand is less, as many urban dwellers produce their own vegetables. In the dry season, when home gardens stop producing, open-space production is often the only source of fresh leaves. Insecure land tenure is by far the most important constraint, followed by fluctuating markets, insecurity of water quantity and quality, insecure sources for inexpensive but good-quality inputs, and lack of knowledge on pest and disease management.

2.5 Periurban production

Stevenson et al. (1996) estimated that about 35,000 farming households depend on periurban fruit and vegetable production for their income. Around 44% of the daily milk consumption (Sumberg 1997) is produced in the periurban areas. Stevenson et al. (1996) surveyed periurban areas within a radius of 15-25 km of the city centre to give an impression of Dar es Salaam's outreach. Depending on road infrastructure and how the city expands, this radius is likely to increase rapidly within the next few years.

In the periurban belt, originally rural farming communities are found. Step by step, they are being swallowed by the city, but their “rural” social system is still partly intact. Stevenson et al. (1996) found that, for 90% of 204 interviewed periurban farmers, agriculture was their primary economic activity; the average farm size was 5.1 acres, of which on average of 1.6 acres was under vegetable and fruit production[3]. A second group of farmers migrated to the periurban areas, 40 % came from the urban and 60% from the rural area. These households have similarities with urban low-density farmers in the inner city. The owner of the house might farm as a sideline or give the tasks to cultivate entirely to dependants or employees. Generally, the production is market-oriented and carried out by men (80%) (Stevenson et al. 1996). Agriculture is not the main motive for acquiring land at the city fringes, as land speculation is a more profitable business.

Crop and livestock production occurs in various combinations. In comparison to the small-scale production systems in the urban areas, only few specialised commercial producers are operating[4].

The periurban produce directly supplies the various markets in town and, on account of the short distance, income opportunities are stable and likely to remain. Most farmers have a mix of marketing strategies. Stevenson et al. (1996) found for fruit and vegetable marketing that 67% are selling to middlemen, 47% directly to urban markets, and 33% is distributed via the village market. Milk is sold mainly to institutional consumers or kiosks (Sumberg 1997). In addition to proximity and infrastructure, crop-production levels and village collection markets also influence the different strategies. Traders tend to go to villages with high production levels, where they are sure to collect the product they want.

3 Sawio (1984) found that 75% of his respondents had farms of 1-10 acres; this corresponds with the findings of Stevenson et al. (1996).

4 There is, however, specialised milk and poultry production on a small scale (Sumberg 1997).

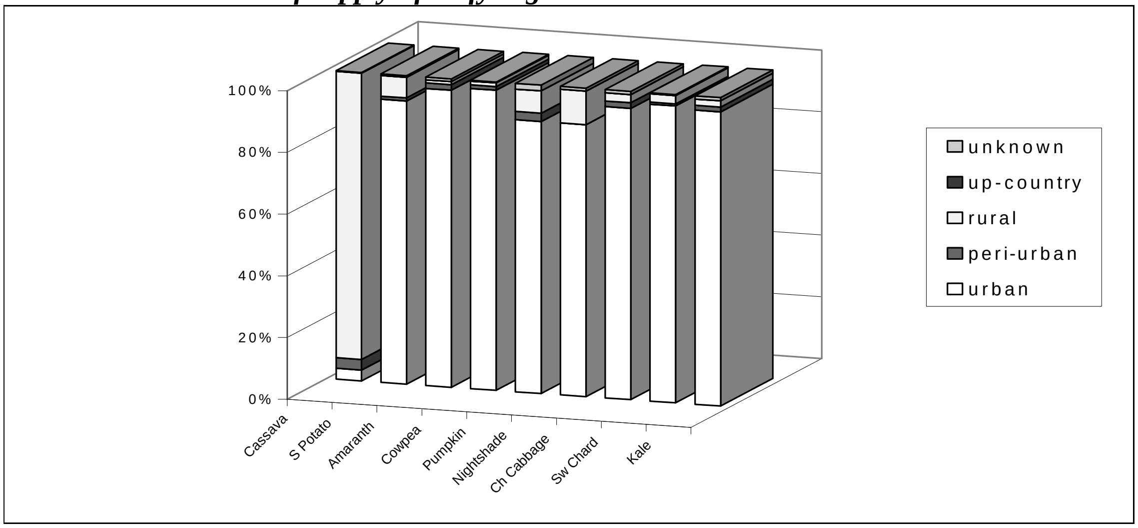
Because of this, several locations within the periurban zone are known for a specific crop. Nevertheless, the most urgent problems mentioned by farmers concern transport and marketing, quantity or quality of inputs available, financial constraints and inadequate technical knowledge.
As the periurban areas of today will be very likely swallowed up by the growing city, it is expected that the cropping pattern and the intensity of the systems will change (less staple crops, less fruit trees, more vegetables, more intensive livestock systems). Periurban production will partly become the open-space production of the future.

3. Food security, health and nutrition

Dar es Salaam rarely faces food shortages. The urban supply pattern follows classical theories. Perishables (e.g. milk, leafy vegetables) are produced in intraurban areas. The periurban belt supplies a mix of perishables, vegetables (sweet and hot pepper, eggplant, okra) and staples (maize, rice, cooking bananas and cassava). Major staple food production comes from the rural areas. Temperate vegetables and fruits (crucifers, leek, carrots, apples, pears) are supplied from up-country, as they cannot be produced in the tropical lowland climate.

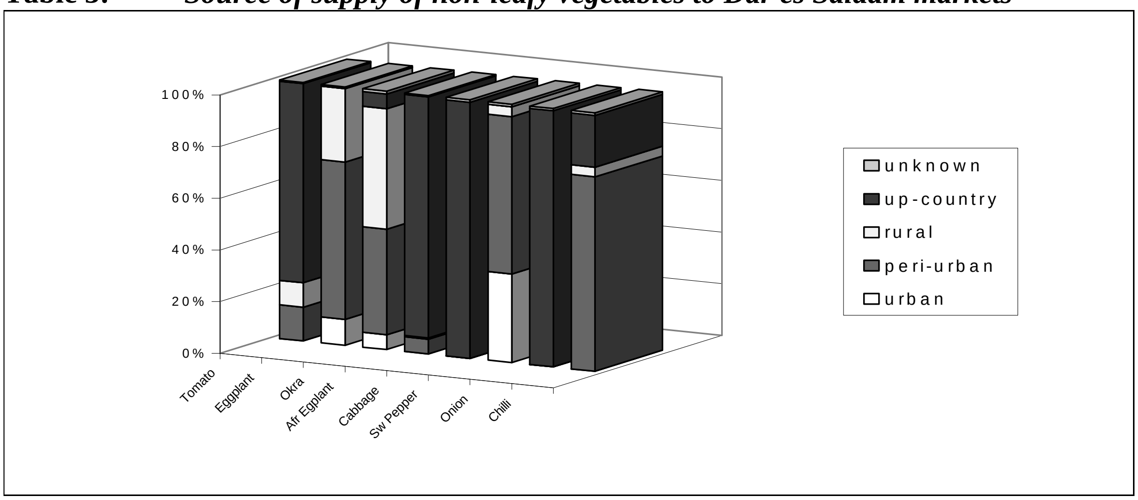
Urban agriculture is vital for Dar es Salaams' food supply. More than 90% of leafy vegetables (especially amaranthus) come from the open spaces and home gardens (Stevenson et al. 1996), while 60% of the milk is produced in urban and periurban areas (Kurwijila 1995).

Table 2: ***Source of supply of leafy vegetables to Dar es Salaam markets***



Source: Stevenson et al. 1996.

Table 3: ***Source of supply of non-leafy vegetables to Dar es Salaam markets***



Source: Stevenson et al. 1996.

Food security at household level is mainly determined by the access of various groups to food. One argument for urban agriculture is the contribution to nutrition and its impact on the health of the urban poor. A one-year survey on consumption habits showed that own vegetable production plays a role in vitamin A and C supply, as purchases of fruits and vegetables from the market are cut when the household budget is tight (Kogi-Makau 1998).

It is difficult to separate the contributions of home production and purchased food. The role of home production varies tremendously with plot size, varieties produced and consumption habits. More indirect effects on nutrition are expected through additional income, which is channelled back into the household food budget. Home gardening and open-space production systems are by far the most important sources for providing food for poor urban households.

Up to now, no direct link between consumption of e.g. leafy vegetables or raw milk in the city and negative effects on health has been established. This is not surprising if one considers the general environment of many urban dwellers.

4. Urban agriculture and the urban environment

In general terms, urban agriculture contributes to preserving open spaces, improving the urban microclimate, beautifying the city and preventing illegal dumpsites and squatting.

A major concern is the quality of crops from urban areas. Despite existing laws to control air, water and soil pollution, there is no strict enforcement in Dar es Salaam. Sewage is usually discharged untreated into streams or rivers. Roadside garages disposing of oil on the ground is a common sight. The traffic is ever increasing and no unleaded fuel is available. In recent years, three surveys analysed the level of carbon oxide (CO), suspended particulate matters (SPM) and sulphur dioxide (SO_2) in the air (Ceest 1996, JICA 1994, NEMC 1994). The results were contradictory: concentrations for CO, SPM and SO_2 both exceeded and remained within WHO standards, depending on the study. However, with ever-increasing (private) transport, the situation will deteriorate if exhaust levels remain unchecked.

The level of water pollution in different streams in Dar es Salaam was also assessed (NEMC 1994, Muster 1997, Qamara & Othman 1996, Sawio 1998). The contamination with heavy metals (lead, cadmium and chrome) was within the Tanzanian standards for irrigation water. The two rogue samples had higher concentrations of lead (Qamara & Othman 1996). Biological agents discharged from households and industries were also present in the water. Only in few samples were the concentrations higher than recommended levels (Muster 1997, Sawio 1996). One sample contained coli bacteria (Muster 1997).

Soils under agriculture contained only traces of heavy metals, which posed no risk for farming. In the immediate vicinity of a major road, however, higher than usual concentrations were detected, which might threaten cultivation in the future (Amend & Mwaisango 1998, Sawio 1996). Contamination of leafy vegetables by heavy metals was analysed by Othman & Bahemuka 1996 and Sawio (1996): lead and cadmium were in excess in several samples, while copper and zinc were below the recommended limits in all samples.

5. Urban agriculture and the household economy

For poorer people, about 70-75% (CARE 1998, Kogi-Makau 1998) of the household budget is spent on food. Kogi-Makau (1998) found that about 20% of the food budget is spent on vegetables and fruits. During the times of the year in which vegetable production is difficult (heavy rains/dry season), consumption of vegetables and fruit is reduced (Kogi-Makau 1998). This suggests that any contribution from home production has a direct impact either on the nutrition level of the family or on the budget by reducing expenditures or earning additional income. Savings can be between 5-7% of a low-income household budget.
Open-space production is often a full-time activity and contributes considerably to the family income. Jacobi (1996) projected that 500 m² of intensive African spinach (*Amaranthus* ssp) production is comparable to a basic government salary (about US$ 60 or 45,000 Tanzanian shillings/month).[5] The same applies to maintaining one or two dairy cows in Dar es Salaam and a well-maintained home garden of 750 m² (Mlozi 1998). Most open-space producers and cattle keepers earn more because they cultivate larger areas and have more cattle.

6. Urban agriculture and gender

Traditionally, both women and men are responsible for providing food for the household, but it is also understood that women have a greater responsibility. Both men and women farm, but their participation is clearly differentiated by the location of the field (Mascarenhas 1995) and is thus closely related to the production system. Women farmers are more numerous, producing on a micro-scale; in terms of yield produced, men are in the forefront as they occupy the larger plots.

There is a strong link between the socio-economic status of the family, the objective of the production and the involvement of women. In poor urban households, women produce mainly for subsistence; very little produce is sold in the marketplace (Kogi-Makau 1995). In medium-income households, both men and women are involved and they produce for both subsistence and sales.

5 The minimum salary in Tanzania is currently TSH 30,000.

Market-oriented production in open spaces is clearly dominated by men. In the periurban production system, both men and women play a role, but more equality is found on farms outside the city, where the situation is similar to the situation in rural households (Mascarenhas 1994). The differentiation of agricultural activities does not make the difference, but the location, magnitude of enterprise and orientation of production does. Most farmers in open spaces are men and farming is their main profession. Usually, no other family member is involved (Kiango & Likoko 1996). Plot size correlates with the single labour force. In contrast, women usually tend to home gardens, as these are more easily combined with traditional household duties and care for children and for old or sick family members.

”Female agriculture” renders more benefits for the household because the produce is either directly consumed in the family or the income obtained is spent on the basic needs of the family. Men contribute part of their earnings, but the share is less.

Access to land is a crucial issue to gender equality in urban agriculture. Significantly fewer women than men own land or houses. Mascarenhas (1995) found that local leaders are less likely to allocate land to women in the informal land distribution system, since women are culturally excluded from possessing land. The study shows that the situation in urban areas is slightly better for women, which gives them a chance to demand a more equitable share of urban resources. However, the constraints still outweigh the opportunities.

7. Factors affecting the development of urban agriculture

The most obvious reason for the popularity of urban agriculture is the need to look for income or food for the household. Urban agriculture is a survival strategy to cope with the declining standard of living in the city.

Access to resources, above all water, is the major constraint for urban agriculture. Farming depends on surface water and groundwater; in many parts of town, the groundwater table is high, allowing for low-cost shallow wells. Tap water is available to a number of households and used for productive purposes. Many areas with easy access to water are already occupied; access to these locations is therefore limited. Competition arises from other informal entrepreneurs, e.g. sand miners or hollow block producers. Dar es Salaam’s tap water supply has been problematic in recent years. Many areas do not have a permanent supply. This is particularly true for unplanned areas. Further extension of urban agriculture will depend on a reliable water source and is likely to be limited.

Sometimes, no or only informal agreements exist between the owner and the user of the land. The insecure land-use title (and sometimes illegal land use) and unclear timeframe in which the land can be used makes open-space production highly insecure. Investments, e.g. in water infrastructure, are not undertaken and conservation measures are not considered.

In many parts, Dar es Salaam still has a low-density settlement structure. There are plenty of open spaces and undeveloped plots which can be cultivated or used for livestock. Some of the river valleys are not suitable for housing, on account of flood risk. Urban farmers use these areas at least part of the year.

Dar es Salaam is the biggest market in Tanzania and there is an increasing demand for food. There is an unsatisfied demand for fresh food like leafy vegetables, milk, eggs and meat, and few larger-scale producers operate near the city. Weak and expensive transport facilities in Tanzania favour urban over periurban and rural farmers.

Tanzanian consumption habits (e.g. green leafy vegetables) favour urban production because these vegetables are very perishable. Tanzanian agriculture depends on imported inputs, which often enter the country through Dar es Salaam. Urban farmers benefit from the proximity to these supply sources.

Dar es Salaam has existing bylaws for urban agriculture, with clear guidelines for livestock. However, law enforcement is rather weak. Especially intraurban livestock keepers take advantage of this situation. The shorter distance to consumers offers an advantage in comparison to periurban producers. Stricter law enforcement would lead to changes in the production system.

Many urban dwellers are of rural origin. Their rural background and knowledge play a role when starting urban agriculture. This also includes a certain status given to one’s own field or own cattle.

Despite the magnitude of demand for fresh produce, the access to the urban retail markets is limited for the individual producers. Those farmers who have developed a close producer-consumer relationship have certain advantages; newcomers face problems.

Lack of knowledge in certain production techniques (e.g. plant protection, crop rotation, economic use of irrigation water) can cause considerable losses in production. Extension agents have little vision as to how to cope with urban farmers.
There is increasing competition for attractive spots (e.g. water supply) and for credit facilities or general support by the local administration. Compared to informal "business" people, urban farmers hardly acquire recognition as such, as farming is often regarded as backward and "rural". Some officials clearly recognise and support urban agriculture; others ignore or even try to inhibit it.

The level of organisation among urban farmers is very low. Most farmers operate on an individual basis. Other sectors increasingly organise themselves, often with the support of external agents. Lack of organisation might lead to severe disadvantages when it comes to allocation of resources from the city authorities.

8. City policies and urban agriculture

In Dar es Salaam, urban agriculture has received attention on various policy levels and is somehow accepted as a feature in the city. The recognition of urban agriculture is reflected in several laws and regulations like the Local Government Act (Section 80) of 1982, the Town and Planning Ordinance (CAP 378, 1992) and the Agricultural and Livestock Policy by the Ministry of Agriculture and Co-operatives (MoAC 1997).

The following guidelines are given (1992):

- ”urban farming” means the carrying out of plant and animal husbandry activities within statutory township boundaries;
- no person shall occupy or use more than three acres of land for urban farming;
- only zero-grazing is allowed and the number of cattle is restricted to four head per person; and
- any farming activity which is deemed to constitute a nuisance in the form of noise or smell or pose a physical danger to the safety of the public shall not be permitted in areas other than those zoned for urban agriculture.

Urban livestock keeping is clearly permitted, but regulated in its practice. Crop production is not further guided. Despite the detailed regulations, authorities are not very strong in enforcing these bylaws. Especially livestock keeping is widely practised, often not following the rules and causing complaints of authorities and city residents. The National Land Bill, which indicates urban land uses, and an update of a Strategic Development Plan for the future development of Dar es Salaam could improve this situation.

The National Agricultural Policy states that: "urban agriculture - although not considered a principal function of towns - has the potential to provide employment, income and is a supplementary source of food" (Sumberg 1996). The city land is categorised according to potential land use. Backyard farming and small-livestock rearing are not regulated, while open-space production falls under the zoning regulations and keepers of larger livestock (cattle) are advised to move to the periurban fringes of town or the rural areas. Urban agriculture is not explicitly mentioned in all policy papers, but is affected by a number of laws and initiatives (e.g. Natural Resource Management, Poverty Alleviation, Employment Generation for Youth).

Considerable research on urban agriculture was conducted by the University of Dar es Salaam – different departments (e.g. geography, chemistry), the Sokoine University of Agriculture and the University College of Lands and Architectural Studies. This research helped to gather information, raising awareness on agriculture and putting it on the agenda of policy-makers.
An initiative carried out under the City Commission was the rehabilitation of city gardens and efforts to green and beautify the city.

The Urban Vegetable Promotion Project implemented under the Ministry of Agriculture and Co-operatives aims to improve vegetable production in the urban areas of Dar es Salaam by upgrading the extension service in town, strengthening the organisational capacity of urban farmers, conducting complementary studies and promoting co-operation with various stakeholders. The AustroProject is concentrating on increasing dairy production in the coastal areas, but also has activities in urban and periurban wards of the city. Non-governmental and community-based organisations (NGOs, CBOs) are numerous in the city, but few have actively promoted urban agriculture on a political level. Some international NGOs working in the urban context have taken it up as an element in community development (Plan International, CARE International). There are various initiatives from local, often informal groups, who generate income through urban agriculture.

9. Outlook

Under the prevailing economic conditions in Dar es Salaam, urban agriculture will at least keep its importance. This applies to different groups in society, but most obviously to the poorer urban population. To many farmers (men and women), urban agriculture offers a certain degree of food security, income and employment. The city residents benefit from the fresh products. The city administration has to admit that urban agriculture, especially crop production, is a productive, although maybe temporary, use of land which would otherwise be used for more (unplanned) settlements or dumpsites. In this respect, urban agriculture can be seen as a tool to safeguard urban areas for future development. Once the various stakeholders realise this, land could be allocated for production on a temporary or even permanent basis. Both future town planning and the urban farmers would benefit.

9.1 Policy

- A coordinator for urban agriculture, open spaces and hazard lands has been appointed by the City Commission;
- bylaws need to be taken seriously, maybe revised and followed up to provide a legal base for both farming and non-farming residents. Special emphasis has to be given to environmental and health aspects. Taxation will have to be discussed, as well. Both farmers and city authorities would have to play a role in monitoring the situation; and
- it is important to realise that urban agriculture is one survival strategy among many for urban households and should not be separated from other informal activities. Up to now, the support to the informal sector focuses very much on petty trading and small-scale businesses, but neglects urban agriculture.

9.2 Allocation of resources

- Portions of land could be officially allocated to urban agriculture (allotments). Dar es Salaam has areas unsuitable for construction, but with a potential for agriculture. Production areas can serve as a green lung or as greenbelt around the city. Urban agriculture can be both permanent and transitory. Possibilities to obtain medium-term lease agreements for urban open space awaiting development would give semi-permanent land rights to farmers and prevent illegal encroaching. Particularly the allocation of land to women should be reviewed. Official campaigns, addressing companies with large undeveloped or underutilised areas, would increase the acceptance of urban agriculture as an urban land use;

- provision of water for agricultural production needs to be taken into consideration when designing town water supplies. The use of expensive tap water should be kept to a minimum to avoid competition with human beings. The use of surface water, shallow wells or rainwater harvesting needs to be encouraged. In cases of water scarcity, rainfed production systems might be promoted.

9.3 Research needs

- There is a need for a broad information base on urban farmers and their farming and household systems to convince policy-makers. Accurate city-wide data on the extent of production and the number of households involved is still lacking;
- additional research is needed on environmental aspects, especially pollution and health risks for consumers, analysed in relation to issues regarding the city’s waste disposal and sewage systems and environmentally safe industrial production. The role of urban agriculture in recycling organic waste should be further explored. Only a close interaction between research and decision-making can fully exploit the potential of the findings.

9.4 Development needs

- Strategies for support – differentiated according to the various target groups – are still in an infant stage. There is nothing like an “average” urban farmer, and it must be clearly defined which forms of urban agriculture should be supported. Strategies should look at the supply function of urban agriculture for the city as well as the role of urban agriculture in urban land use. "Concepts" do not necessarily have to aim at urban agriculture alone but can include waste management/composting, with support targeting the urban poor in community and youth programmes;
- urban farmers need to organise themselves to articulate their needs and give weight to their demands. Direct support depends by and large on the organisational capacity of the farmers in their community. The need farmers express for extension and other services must be taken seriously. A clear concept, which takes into account the differences between rural and urban (intra- and periurban) farmers and their environment, has to be put in place and extension topics adapted to urban conditions. Special emphasis should be given to economic use of resources, intensive small-scale production and environmental aspects. Extensionists should act as a link between farmers and service providers, which differs from their conventional role in rural areas;

- market-oriented farmers need more knowledge on marketing, legal matters, bookkeeping and credit. There is a need to encourage informal group structures to become formal, to lobby jointly for their own rights and act as a pressure group; these are well-known elements for all informal sector activities, including urban agriculture.

Even with increasing population densities in certain parts of the city, urban agriculture will not disappear. Production sites might disappear in one area while they emerge in other parts of town. In this respect, urban agriculture has elements of shifting cultivation. Urban agriculture plays an important role in Dar es Salaam. More and more stakeholders acknowledge this, and steps are being taken to support urban dwellers in their efforts to make a living. It is a process in which a number of people need to join in, but the process has started.

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URBAN AGRICULTURE IN HARARE: BETWEEN SUSPICION AND REPRESSION

Beacon Mbiba

1. Introduction

Harare is the capital, the largest commercial centre, and the seat of political and administrative power in Zimbabwe. The 1998 population of Harare was around 1.9 million inhabitants. The second largest city of Zimbabwe, Bulawayo, has 1 million inhabitants.

Harare's history as a modern city dates back to 1890, when it was established as a fort by settler colonialists sponsored by the British South Africa Company. Harare is located on a watershed in the Northeast of what is called the high *veld* of Zimbabwe. This is a plateau 1500-2000 m above sea level, which stretches from the southwest of the country, encompassing Harare, extends northwest to Chinhoyi City and to the east beyond Marondera. The high veld climate is cool, with annual temperatures in the range of 10-26^{o}C and with an average annual rainfall of 800-1000 mm. The terrain is relatively flat savanna grassland (HCMPA 1985: 9).

Table 1: ***Key Statistics for Zimbabwe and Harare City***

	Zimbabwe	**Harare**
Area	390 757 km^2	872 km^2
Population (1998)	12.2 million	1.9 million
Growth rate	3.5%	5%
Natural growth rate	3.5%	3.1%
Persons / km^2	31	2179
Nuclear household size	5	4
Poverty levels	40%[1] or 62%[2]	44%[3]
Unemployment	45-50%	45-50%
Urbanisation levels	40-50%	Not applicable
Major threats	AIDS, unemployment & economic collapse	AIDS, unemployment & economic collapse

Harare has a sprawling structure dominated by a radial road network with the central business district (CBD) at its core and industrial areas to the east and south.

Until Zimbabwe's independence in 1980, Harare (then "Salisbury") was developed along racial lines with large open spaces left as buffer zones in a bid partly to separate black people from white people.

So, to the north and northeast were white residential areas on lot sizes of about 1 acre, while black people were confined to the southwest (windward of the industrial areas) on plot sizes of about 300 m^2.

Since Independence, although the spatial structure of the city has not changed, racial structure is giving way to economic classification. The white areas are now called low-density areas (1000 people/km^2) and the black townships are called high-density areas (>2000 people/km^2). Recent surveys have failed to establish any discernible ethnic clustering within the residential areas of Harare (Mbiba 1999).

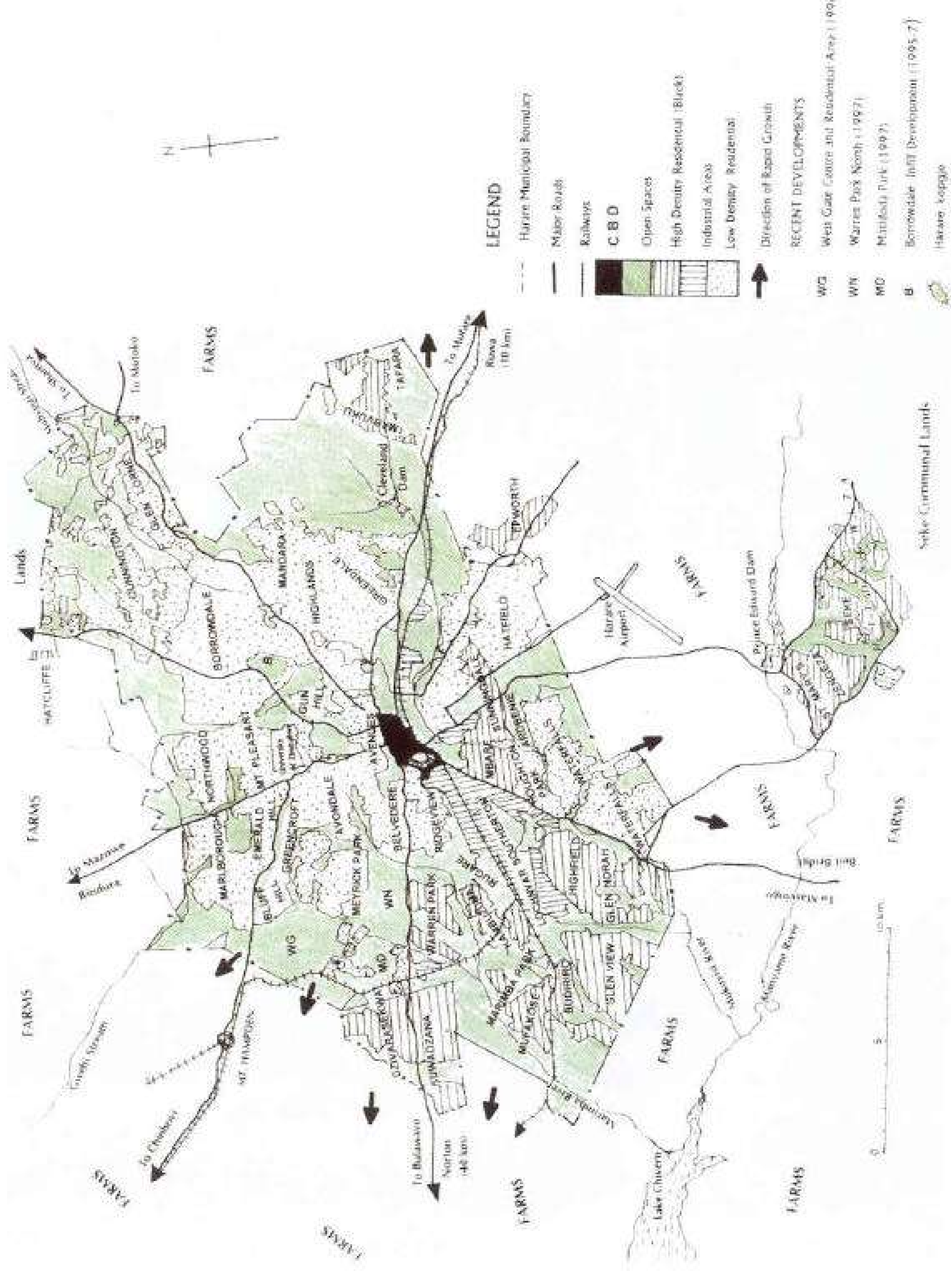
Chitungwiza Municipality, about 25 km southeast of the CBD, was developed as a dormitory town to house black people during the last decades of settler rule. Functionally, it is an integral part of Harare, although it is administered separately.

The current development pattern is dense construction within the city through in-fill residential development on open spaces; high-rise development in the city centre; and outward growth in areas with adequate infrastructure to the west, south and east of the city. Informal settlements are legally discouraged and force is used to demolish squatter settlements (Auret 1994). However, a few squatter settlements exist in the urban periphery and in low-lying areas within the city boundaries, where they are generally out of view from the public (Butcher 1995: 4). Around the city, large-scale commercial farms are found.

2. Urban agriculture in Harare

Urban agriculture in Harare is defined as the production of crops and/or livestock within the administrative boundaries of the city. Harare has several conditions favourable to urban food production. These include a relatively wet climate, large residential plot sizes and large open spaces within the city boundaries.

A key feature of the Harare environment is the *vlei* phenomenon. Vleis are seasonally waterlogged drainage systems that occur on both clay and sandy soils.


LEGEND
Harare Municipal Boundary
Major Roads
Railways
C.B.D
Open Spaces
High Density Residential (Block)
Industrial Areas
Low Density Residential
Direction of Rapid Growth
RECENT DEVELOPMENTS
West Gate Centre and Residential Area (1996)
Warren Park North (1997)
Borrowdale Infill Development (1995-7)
Harare kopje

Vegetable and maize production (on-plot) in the poor Mbare high density area (Picture Beacon Mbiba)

Maize production around school buildings. During the rainy season almost all available space is used for the production of this staple food (Picture Beacon Mbiba)

During the wet season (October to March), they become heavily waterlogged, resulting in surface marshes along all drainage systems. The vlei “soils” get wet with the first rains and then retain moisture long into the next wet season. Traditionally, communities have taken advantage of the vlei properties to plant an early crop and a late crop, thus enabling them to produce two harvests a year from the same piece of land. The proximity of vlei soils to streams makes them favoured areas for gardening.

Vlei “soils” have long been left unbuilt because they expand tremendously during the wet season and shrink and crack in the dry season. This damages roads, sewers and other built structures needing costly maintenance. Some of the resulting characteristic green open spaces are actively used for recreation.

Urban agriculture can be classified in three categories based on its location:

On-plot agriculture: farming practised on the plots around houses, like backyard gardening. It involves mainly crop production. Maize is the main crop produced during the wet season. Vegetables are produced throughout the year. Health laws prohibiting livestock rearing are largely successful. At most, a negligible 1% of households keep small livestock, such as poultry, in the city (Kanji 1995). During dry spells, tap water is used to irrigate crops. In low-density areas, borehole water is also used. Water use has not been quantified, and there are no meaningful data regarding quantities used of manure, fertiliser and other inputs. Poor households, tenants and recent rural-urban migrants hardly have access to on-plot land.

Off-plot agriculture: this is conducted in public open spaces, utility service areas and agricultural allotments. All reports regarding off-plot production, however, are about agriculture taking place in public open spaces, where production is largely “uncontrolled”, “illegal” or heavily “contested” (Mbiba 1995, Mudimu 1996, Boywer-Bower & Drakakis-Smith 1996). The production is mainly for home consumption, although a slightly higher percentage is marketed as compared to on-plot production. The poor and vulnerable groups, who could participate in this sector, are progressively pushed out by higher-income households. As in the case of on-plot production, women and children provide the bulk of the labour. With rapid urban development over the past few years, large agricultural allotments within the city boundary have almost disappeared and no new land has been added to formal agricultural allotments since 1980.

Periurban agriculture: this third category is the production of crops and livestock in areas outside the city boundary, formally rural agriculture - up to a radius of 150 km - which is economically integrated into the city. There has been no study or programme to explicitly link this to urban employment, food needs or any other urban dynamic. As is the case for urban agricultural allotments, the periurban sector has not been subject to any quantitative investigation. Because of the availability of land and existing rural agricultural support networks, this sector offers immediate and viable options for enhanced food production to meet the employment and nutritional needs of Harare.

Table 2: ***The status of on-going urban agricultural activities***

Feature	**On-plot**	**Off-plot** (both legal and illegal)	**Periurban**
Location	On property in both high- and low-density areas	Public open spaces, utility service area all over the city, and on allotments	Outside city boundary in rural areas
Consumption mode	Mainly subsistence, more commercial in low-density areas	Mainly subsistence, slightly more marketed output than on-plot production	Subsistence in the smallholder sector but marketing on the increase
Crops produced	Maize, vegetables and fruit	Maize, sweet potatoes, fruit and vegetables	Maize, vegetables, fruit and other horticultural produce
Plot size	Up to 50 m^2 and can be as high as 1 acre in low-density areas	Average 200 m^2 up to 2 acres per household cultivator	3 acres for smallholders and 5 ha or more for large-scale producers
Livestock	Negligible	Negligible	Poultry, pork, milk, beef, etc.
Households involved	80% of properties in summer and 60% in winter; 70% property owners, 30% lodgers	At most 25% of Harare households; property owners dominate	Those with land-access rights
Fertiliser use	Low levels	Low levels	High levels (quantities not available)
Involvement of the poor	Very low	Low	High potential
Status of research	Fair in high-density areas, very little in low-density areas	Fair in all areas	Not well studied from an urban perspective

NGO support	None	Negligible to none	Low and likely to increase
Commercial support	Low	None	Reasonable and increasing
Official attitude	Control	Control	Positive and increasing
Potential for future	Low	Low	High

3. The impact of urban agriculture

Despite the potentially favourable conditions for urban agriculture, urban households meet their food needs from rural produce and acquire their incomes from a diverse range of informal activities, of which urban agriculture is only a tiny component. A study by Environment & Development Activities (ENDA)-Zimbabwe (1996: 82) concluded that “there is very little difference between the non-agriculturist and urban agriculturist diets”. Bowyer-Bower and Drakakis-Smith (1996) show that, even for the households that grow food, the contribution from urban-produced food is small compared to food from rural areas.

Nevertheless, the use of urban space for crop production increased during and after years of drought (e.g. 1982/83, 1988/89 and 1991/93). The economic collapse and, in particular, the decline in formal-sector employment and incomes since 1990 has contributed both to the increase in off-plot urban agriculture and to direct rural-to-urban food procurement (Mbiba 1993, 1995; ENDA-Zimbabwe 1996; Boywer-Bower & Drakakis Smith 1996; Masoka 1997).

Over 60% of the maize and leafy vegetables produced in on-plot agriculture is consumed in the household. Of the remaining 40%, 75% is sold from the home or at neighbourhood market stalls. The percentage of marketed produce in off-plot agriculture is slightly higher than that of on-plot agriculture.

The production follows the seasons, as there are long winter periods when vegetable and fresh foods and fruit are scarce. Researchers have found it difficult to determine quantities produced, consumed or marketed, largely because of the complex food flows mainly originating from rural areas.

4. Urban agriculture and the environment

The status of urban agriculture in Harare has been guided by the public and official view that urban agriculture poses a threat to the environment, and research has attempted to establish the extent of the threat (e.g. of malaria, hydrological issues, soil erosion, ecological changes, chemical pollution). Potential benefits such as CO_2 reduction, composting and microclimate improvement remain unexplored. The key research findings are summarised in Table 3.

Table 3: ***Potential environmental implications of urban agriculture***[3]

Category of environmental impact	**Examples of environmental effects**	**Study results**	**Implications of effects**
Change in the hydrological regime of the area	• more run-off and land surface flooding; • less infiltration.	• run-off increases by 350% on average; • infiltration reduced 28.5% on average.	• flooding, damage to property, transport routes and infrastructure; • costs of maintenance.
Soil erosion	• lowering of the land surface; • deposition of eroded sediment; • small dust particles in the air.	• soil loss on 40% of cultivated sites exceeds tolerable levels; • high levels of deposition of eroded sediment; • high air pollution.	• logging of city drains, nuisance to transport; • health problems; • increased costs of maintenance.
Ecological changes	• changes in species types; • reduced biodiversity; - loss of soil cover, loss of tree cover.	• high; • high; • high.	• loss of species habitat; • loss of biodiversity; • soil erosion .
Chemical pollution	• lead uptake of crops from exhaust fumes; • vegetation toxicity from industrial effluent; • reduction in water quality.	• high; • probable; • probable.	• algal blooms, potential health hazard to consumers, threat to wildlife, increased costs of water purification.
Landscape and aesthetics	• loss of scenery and diversity of environment.	• indeterminate.	• loss of recreational spaces; • increased costs to access alternatives.
Diseases	• vector-borne diseases.	• indeterminate.	• potential for diseases related to water, refuse, manure and animals; • costs of monitoring, control and treatment.

Source: Bowyer-Bower & Drakakis-Smith 1996.

5. Gender dimensions of urban agriculture

Women provide the bulk of labour and management inputs for urban agriculture. The proportion of women cultivators in the off-plot sector ranges between 63% (Mbiba 1995a: 39) and 55% (Mudimu 1996:180). Of these female cultivators, over 80% were working on their '"own plots". In the higher-income areas, more women employ manual labour. Mudimu (1996:185) found that 24% of the men working on the plots were hired labour and that 59% of the men were assisting their wives. The dominance of women in urban agriculture extends from production to marketing. Up to 68.8% of those involved in marketing were women (ENDA-Zimbabwe 1996: 40). At all stages of production and marketing, children share the bulk of the labour with their mothers.

Women in the cities are responsible for food procurement to the same extent as women in rural areas. Urban agriculture extends the working hours and burdens of women relative to those of men, especially with the collapsing economy posing more and more difficulties to the household subsistence. Any support to the sector should therefore aim to reduce time costs, as well as management, marketing and administration costs, apart from aiming to improve production.

The increasing number of men active in urban agriculture can be attributed to increased unemployment, as thousands of men are retrenched from formal employment. As attitudes towards urban agriculture become more favourable, there might be a danger that men will displace women from an activity in which women have been engaged for years. At the same time, while paying attention to urban cultivation and women, it must be remembered that basic issues like women's access to education and skills have to be tackled, including opportunities in those lucrative self-employment and business areas currently monopolised by men.

6. Existing city policies regarding urban agriculture

Despite the stagnation of rural agricultural production and the recent economic collapse, both policy-makers and households do not consider urban areas to be a viable solution to food security, job creation and environmental improvement. In the 1980s, urban agriculture received a boost through a policy of the ruling party ZANU (PF) promoting co-operative formation. Ever since, however, urban agriculture's role is largely viewed with scepticism.

The general opinion is that there is still ample land in rural areas for production.

Rather, the problem is the inequitable distribution of that land. Consequently, the priority and urgent political challenge is to simultaneously enhance rural production and to redress the land imbalances. As all individuals have a right to rural land, promotion of urban agriculture is considered to be detraction from the real burning national land question.

While the municipal provisions accommodate urban food production, they give local authorities the discretion to determine the desirability and extent of the activity at any point in time. Consequently, institutional responses to urban agriculture have varied from extremely prohibitive measures to supportive programmes. The nature of the response depends very much on the personalities holding various positions in the city council, and the city mayor in particular.

Officials generally tolerate on-plot crop production, but livestock rearing is strictly controlled. The controls have also ensured that no livestock rearing exists in off-plot agriculture.
The approach to off-plot crop production at times seems accommodative but, in some years, can be drastically prohibitive. Crops are often destroyed; even those supposedly grown with approval from councillors and city officials. Contamination of food during the retailing process has been at the core of intolerant official responses, who argue that the elementary methods used in these processes put the urban population at risk to cholera (Mbiba 1994; 1995).

There are no loans, subsidies, credit facilities or extension services. Extension services for urban agriculture in Harare are not provided, because urban agriculture remains an “ad hoc” activity shrouded in “illegality” and “uncertainty” (Mbiba 1994, Masoka 1997). The legal and institutional voids that limit support for urban agriculture continue largely to prevail, on account of the absence of political commitment to change the status quo.

7. Urban agriculture: facilitating and inhibiting factors

In Harare, urban agriculture is considered a contradiction in terms. The dominant image of the city is one where agriculture is absent. For a long time, it had not been clear what urban agriculture is or should be. It is also considered misleading to talk of urban agriculture in the context of rural land opportunities and the national land question.

A second conceptual constraint has been the use of disparate entry points (environment, employment, gender, poverty, etc.), making it difficult to emerge with a solid position on urban agriculture.

Urban agriculture has been mainly put forward as an alternative for the poor, disregarding other groups whose role in urban agriculture is also critical. Upper-income groups, rural-urban dynamics at household level and the urban economy in general have not been seriously taken into account. At present, the poorest and most vulnerable groups do not benefit from urban agriculture, as they face increasing competition from middle- and higher-income households whose standards of living have been collapsing.

Within urban areas, urban agriculture is a weak competitor against built development uses. Land for potential food production in the city is shrinking rapidly. Thus, urban land is inherently contested. Without resolution of political priorities, urban agriculture's future in Harare will remain precarious.

With respect to off-plot crop production, the uncertainty of land tenure and the associated illegality of farming preclude productive investments. This is further compounded by problems of institutional inertia and conflicts that hinder comprehensive development of the sector. Political decisions regarding urban agriculture have been erratic, contradictory and at variance with legal regimes and written policies. There has been nobody (person or institution) to challenge this political inconsistency. The few NGOs that have attempted to become involved in urban agricultural issues are discouraged by the political conflicts and resort to duplication of research efforts or one-off workshops (Masoka 1997, Mbiba 1998a).

In this context, technical constraints, which could be overcome by technical support programs in production, storage and marketing, are secondary to the political inhibitions.

8. Perspectives for future development strategy of urban agriculture in Harare

The large numbers of unemployed people, poverty levels close to 50% and economic collapse make it urgent that any potential offered by urban agriculture for generating employment and income and for producing food be explored.

In recent years, research and lobbying by researchers has helped to create a basis for dialogue around the potential for formal promotion of urban agriculture. To achieve wider acceptance on the activity in Harare, one could simply focus on food for the city. In spatial terms, the strategy should be centred on periurban areas, where land is more readily available. The target for policy and programs should be to increase food production and make it available, affordable and adequate in both quantitative and qualitative terms throughout the year.

Related to “food for the city”, the strategy should push for a policy which sets clear land-use priorities in and around urban areas. Through this policy, all agriculturally productive land should be protected from the urban sprawl. Within the city, the strategy should streamline ownership and access to open spaces.

A challenge for academics and researchers is to maintain the momentum towards reshaping attitudes regarding “what is a city”. Their work should relate urban agriculture to the everyday needs of the residents. Research should also be integrative: focusing on the poor as well as the rich as well as rural-urban dynamics. The urban food matrix within urban-rural dynamics needs to be further investigated for its potential in tackling the city's food requirements. Also in need of further investigation is on-plot production in the low-density areas and the periurban zones.

Proponents of urban agriculture should use the permissive legal framework, rather than challenging it, as has been the case so far in Harare. Existing laws are permissive and the challenge is to discover how these laws can be utilised; our task is to ensure that they be used in a consistent and transparent way which will bring more certainty to the sector.

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1 Poverty level defined in terms of people living on less than 1 US$ per day, 1996 levels.

2 Poverty in terms of households with income per person below the level sufficient to provide basic needs as published by the Government in 1996.

3 The impact is assessed against “virgin” conditions; i.e., where urban cultivation is not practised, e.g. on experimental plots or sites where no cultivation at all is taking place. The table refers to cultivation in general: on-plot, off-plot or periurban cultivation.

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URBAN AGRICULTURE IN THE CITY OF HAVANA: A POPULAR RESPONSE TO A CRISIS

Mario Gonzalez Novo and Catherine Murphy

1. Introduction

The city of Havana covers an area of 721 km^2, 0.67% of the total area of Cuba. Unlike many other cities in developing countries, Havana has not been plagued by a massive influx of migrants. The population growth is 1.8% per year. The city has about 2.2 million inhabitants, or 20% of the total population of Cuba, of whom 1.5 million are in their economically active age. The population density is 3,014 persons/km^2. The highest density is found in the districts of Centro Habana (45,093 inhabitants/$km^{2)}$, Habana Vieja (21,774 inhabitants/km^2) and Diez de Octubre (19,480 inhabitants/km^2). Administratively, the city of Havana is one of the 14 provinces of Cuba. It is divided into 15 municipalities, which are subdivided into 104 people's councils (*consejos populares)*, the government structure at neighbourhood level.

Havana has a tropical coastal climate with a mean annual temperature of 25^0C, a relative humidity of 79% and average annual rainfall of 1,400 mm.

2. The emergence of urban agriculture in Havana

Since the revolution of 1959, being able to eat sufficient food has been asserted as a basic human right by the Cuban Government. One of the ways by which the government secures access to food is a distribution system guaranteeing basic food packages at subsidised prices.

Since 1959, much work has been done to develop the national agricultural sector into a highly mechanised sector, with intensive use of agrochemicals. Most attention was paid to the production of sugarcane and other export crops. In the mid-1980s, over 50% of the total foodstuffs consumed in Cuba was imported. The imports were made possible by the favourable terms of trade of the socialist bloc (especially for sugarcane), as well as by cheaply provided Russian oil, of which part was re-exported.

When the Socialist Bloc disintegrated, Cuba lost access to cheap fossil fuels, direct food imports and the agricultural inputs on which it so heavily depended for its export production. Imports dropped: in 1993/94 supplies for agriculture dropped by 67%. Cuba was thrown into a severe crisis, commonly referred to as the “special period”. The crisis was further compounded by the further tightening of the US embargo. Food shortages occurred, most severely in Havana. It has been estimated that food availability declined as much as 60% between 1991 and 1995. Extensive food rationing was instituted to ensure equitable distribution.

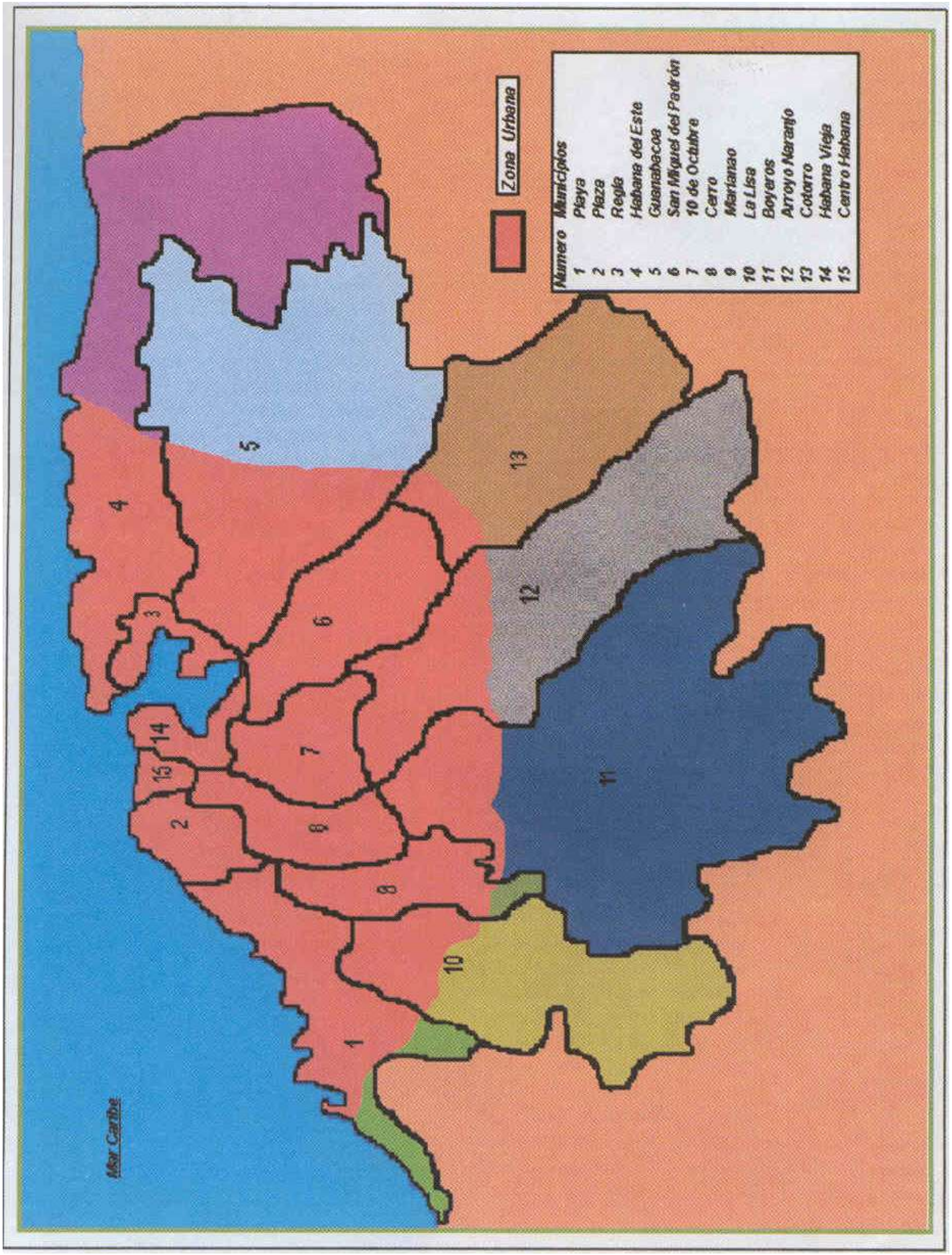
Before 1989, urban agriculture was almost non-existent in Havana. There was no need, not even for the poorest residents, to grow food, as food was distributed by the State. However, because of the food crisis, urban agriculture emerged. President Fidel Castro proclaimed that no piece of land should be left uncultivated. So even on the front lawn of the Ministry of Agriculture (MoA), crops were planted.

The strongly urbanised district of Havana was not exempt from the search for non-conventional food-supply programmes. A start was made to decentralise production and to link production directly to transportation and consumption patterns. The self-supply (*autoconsumo)* plan, initiated in the late 1980s, was expanded. This plan to increase local food self-sufficiency reduced the need for transport, refrigeration, storage and other resource-demanding activities. All over Havana, urban gardens were started. For the residents, it was not so much a question of whether, but rather how, they could produce food or raise animals.

3. Characteristics of urban agriculture in Cuba

The main idea of urban agriculture in Havana can be described as “Production in the community, by the community, for the community”, which refers to the cycle of producers, products, marketing and consumers. Urban agriculture is very much seen as a way to bring producers and consumers closer together in order to achieve a steady supply of fresh, healthy and varied products directly from the production site to the consumer.

In general, urban agriculture is an intensive, high-input (organic pesticides and organic manure), high-output system favouring the production of a diversity of crops and animals throughout the year. Urban farming is a common practice and extremely heterogeneous. It involves efficient use of water; careful management of soil fertility, crops and animals; and close attention to environmental protection.


Zona Urbana
Numero Municipios
1 Playa
2 Plaza
3 Regla
4 Habana del Este
5 Guanabacoa
6 San Miguel del Padrón
7 10 de Octubre
8 Cerro
9 Marianao
10 La Lisa
11 Boyeros
12 Arroyo Naranjo
13 Cotorro
14 Habana Vieja
15 Centro Habana
Mar Caribe

Organopónicos INRE 1. One of the 20 existing organopónicos in Havana (Picture Department of Urban Agriculture Havana).

Marketing point part of the concept "Production of the neighborhood for the neighborhood" (Picture Department of Urban Agriculture Havana).

It is strongly supported by the government, and governmental institutions play an important role in the organisation of urban farming. The Havana City Government passed a law prohibiting the use of chemical pesticides in agriculture within the city limits. Thus, the crops are grown almost entirely using active organic methods.

In Havana, urban agriculture is a quickly developing sector in which a lot of new ideas and adaptations from producers as well as scientific institutions are tested.

4. The organisation of urban agriculture

Until recently, most of the agriculture in Cuba was carried out on state farms, with each farm having certain production targets. However, in September 1993, the Cuban Government issued Law No. 142, breaking up the majority of large state farms into Basic Units of Production (*Unidades Básicas de Producción Cooperativa* (UBPCs), small collectives owned and managed by the workers. Law No. 142 aims to connect the workers to the land, encouraging a concrete feeling of responsibility, to make the collective of workers and their families self-sufficient, to connect income directly to the degree of productivity and to increase autonomy of governance.

Also, the previously banned farmers' markets have been allowed to operate again. In October 1994, 121 farmers' markets opened around the island. Most producers have state contracts meaning that their produce is used in the state distribution system. After complying with these contracts, however, all food producers are allowed to sell their excess produce directly to consumers rather than through the state redistribution chain.

Decentralisation has not meant that the government has stopped playing an active role in urban agriculture. On the contrary; for the relatively quick turn-around of the production system, from chemical-based to organic-based, and for the success of the urban agriculture programme, the strong government (national and provincial) support has been decisive, in addition to the strong educational base of the population. In this way, the booming urban-gardening movement was supported through the world’s first co-ordinated urban agriculture programme, integrating: 1) access to land; 2) extension services; 3) research and technology development; 4) new supply stores for small farmers; and 5) new marketing schemes and organisation of selling points for urban producers.

4.1 Access to land

The high demand for agricultural land needed regulation to settle land-use rights for gardeners.
The first priority for the development of urban agriculture was to make land available for growing food. Therefore, land-use rights for urban gardeners had to be secured. Emphasis was put on giving land to all those who wanted to grow food in the city. The reorganisation was led by the newly created Urban Agriculture Department. The department worked with the *Poder Popular* (Legislative Council) to change city laws so that gardeners would have legal priority for all unused space. Citizens who wanted to set up a garden could solicit the local government, usually requesting a specific plot. Land-use rights are thus being distributed through the popular councils or the municipality.

This decentralised strategy has allowed for land transfer to happen in a timely manner, with little red tape. Even unused private land was turned over in usufruct to those who wished to cultivate it. However, if the gardener would not produce for six months, all rights would be returned to the legal owner.

5. Production systems

By 1998, over 8000 officially recognised agricultural production units were operational, in which over 30,000 people were working. Women play an important role in urban agricultural production; however, the majority of the official work force in urban agricultural production are men (ca. 80%). With approximately 30% of Havana's available land coming under cultivation, the city farms and gardens can be subdivided into five main categories.

5.1 Popular gardens

Popular gardens (*grupos de parceleros)* managed by the cultivators are the most popular form of urban agriculture in Havana. These gardens more or less spontaneously emerged in yards and on balconies, patios and rooftops in response to the problems of the "special period". In the first years of the crisis, almost all of the food harvested in Havana's popular gardens went directly to the families[1], close

1 Angela Moskow (1995) found in her survey among 42 gardeners that, on average, 10 people regularly eat out of each garden.

friends and neighbours of the producers. With the relaxation of laws governing the sale of urban produce, production increased and allowed gardeners to also make economic gains.
On the other hand, gardeners also make considerable food donations to the neighbourhood, especially to schools and daycare centres. This is considered to be only reasonable, since the communities provide the land to the gardeners free of charge. Today, over 26,000 popular gardens cover 2,438.7 ha in Havana and produce 25,000 tons of food each year.

The majority of gardeners already have an official job and farm in their spare time. A large number of the gardeners are retired men and women. The role of women in gardening is remarkable since, in Cuba, agricultural work is traditionally considered to be a man's job.
Many gardeners are organised into *Grupos de Horticultores* - voluntary organisations of gardeners working in the same neighbourhood. Today, there are 908 gardeners' groups with a total of 17,900 affiliates.

5.2 Basic Co-operative Production Units

Basic production co-operative units (*Unidades Básicas de Producción Cooperativa*, *UBPCs*) are the result of the splitting up of state farms. They can be found throughout the country, usually with about 5-10 members, depending on the available resources. The UBPCs produce different kinds of products: some produce vegetables, e.g. in the *organopónicos*; some produce fruit in orchards; and 16 UBPCs in Havana are part of the Ranching Association and produce milk.

5.3 Farms of the State Co-operative Supply Units

The production of these farms (CSUs) is intended to supply the *cafetarias* of factories[2]. Most of these farms are on site, as the Worker Centres used to have idle land which, after the crisis, was made productive. Most of the CSUs produce a surplus, which is sold to the workers at the low "State prices". They might also directly sell to the public, often from an on-site stand. The organisation of a CSU depends on the management of the workplace. It might be that a fixed group of employees tills the land while, in other CSUs, a system is in place whereby the

2 In Cuba, the majority of the factories and government institutions have cafetarias where a meal is offered to the workers for a small charge.

agricultural work is divided among all employees. Often, the profits of the farming are redistributed among the farmers in one way or another.

5.4 Individual farms

Within the city limits of Havana, a number of individual farms (*Campesinos particolares)*
exists. The typical farm size is about 13 ha. Most of the land is held in usufruct. Most of the milk and cut flowers sold in Havana originate from these farms. The milk is sold not in farmers' markets but distributed through the state distribution system.

5.5 State farms

There are three state-run agricultural enterprises (*Empresas Estatales*) in Havana: *Empresa de Cultivos Varios* (Mixed-Crop Company), *Empresa Horticola Metropolitana* (Metropolitan Vegetable Company) and *Empresa Pecuaria* (Animal Production Company). The Mixed-Crop Company is found on the fringe between the more urbanised and the more rural zones. The enterprise is organised into 21 municipal farms. Each farm supplies the enterprise at "reasonable prices". This produce is then distributed through the state distribution system. Most of the land of the farms is dedicated to fruit production, amongst other things, for the tourist market.

A group of 20 *organopónicos* form the Metropolitan Vegetable Company, which covers a total of 19 ha of irrigated land, permitting the *organopónicos* to gain high yields (up to 30 kg/m^2). As the groups form a state farm, the financial responsibility is with the government, which supplies the money and uses the produce in the food distribution system.

5.6 *Organopónicos* and intensive gardens

A special feature of Havana's agriculture is the so-called *organopónicos*. These are raised container beds with a high ratio of compost (50%) to hydroponic fibres or soil (50%). The *organopónicos* are used mainly for intensive vegetable production. This system works very well in urban settings; for example, on paved vacant lots or plots with poor soils.

As already mentioned, 20 *organopónicos* together form a state enterprise. Other *organopónico* units are, however, organised as a UBPC. The biggest *organopónico* is managed by the Federation of Cuban Women and employs 140 women.

Where the soil is appropriate, the system of *organopónicos* is increasingly replaced by *huertos intensivos* or intensive gardens. The gardens use intensive gardening methods on raised beds without a retaining wall, promoting plant spacing for maximum yield per area and the incorporation of organic matter. Today, 773 production units of *organopónicos* and *huertos intensivos* cover 386 ha with an average production of 21 kg/m^2. Many of the *organopónicos* and *huertos intensivos* have their own stalls next to their fields and cater for a particular market with prices somewhere between State prices and those of the free market (*Mercado agropecuario)*. However, even the successful system of *organopónicos* and *huertos intensivos* faces certain challenges, as obvious in the 11-point programme to improve the *organopónicos*/*huertos intensivos* system as announced by Mr Alfredo Jordan, the Minister of Agriculture:

- to strengthen the production in *huertos intensivos;*
- to dedicate 10 m^2 per inhabitant of Havana to *organopónico/huerto intensivo* by the year 2002;
- to appoint one person in each municipality to be in charge of all organoponics, including construction and maintenance;
- to promote planting more fruit and flowers in the schemes;
- to continue to hand over land in usufruct to UBPCs and individual farms and to increase the organisation of the plots and growers;
- to increase crop diversity and, more specifically, reach the full potential of leafy vegetable and condiment production, and increase the production of tomatoes, green beans, onions, garlic and chives;
- to build direct relationships between *organopónicos* and all municipal organisations;
- to address irrigation problems;
- to improve soil fertility through the use of compost and bio-fertilisers;
- to expand biological plant protection; and
- to expand the agricultural stores[3] into houses for intensive outreach (*Casa de Atención Intensivo).*

3 See point 7.2: *Tiendas Agricolas*

6. Production of urban agriculture

The total area of Havana is 721 km^2, of which 299 km^2 is used for agricultural production, in which a very high diversity of crops is produced (see Appendix 1).

Table 1*: Agricultural production in the City of Havana*

Year	**1995**	**1996**	**1997**	**1998**
Production (tons)	44,243	80,462	96,653	113,525

Table 2: ***Urban agricultural production in Cuba per production system (1997)***

Sector	**Production (tons)**
Huertos populares	28,385
*Autoconsumo*s	23,389
Organopónicos	47,651
Campesinos particulares	44,480
Empresa de Cultivos Varios	16,095
Total	**160,000**

Source: Grupo Provincial Agropecuario 1998

The *popular gardens* not only overcame the monotony of available foods, but even brought back traditional crops (passion fruit, sesame, custard apple) and introduced new crops such as spinach. Among the various production types, some differentiation can be observed. Home gardens and workplace gardens mainly produce for self-consumption, so the gardeners plant what they want to eat, such as fresh vegetables, roots and tubers (cassava, sweet potato and taro), condiments and some fruit. Many also raise small animals for meat, milk, eggs, etc.

*Autoconsumo*s raise similar crops, as they produce to cater the lunch of the workers in the workplace. When space is available, the *autoconsumo*s often raise animals, sometimes even dairy cattle. In 1997, the *autoconsumo*s produced 8,355,000 eggs, 1,392,000 litres of milk and 240 tons of meat (Fuster 1997b).

Organopónicos have another role and focus on providing the complementary foods that residents cannot obtain from the ration, and which are best bought fresh daily. These products include lettuce, green onions, New Zealand spinach, tomatoes, green beans and some other vegetables and condiments.

6.1 *Mi Programma Verde*

Deforestation is also a problem known to Havana. In order to protect, maintain and create new forested areas, the *Mi Programma Verde* (My Green Programme) was initiated. The programme includes wooded areas and grouped and individual trees found in gardens, patios, parks. Schoolgrounds, etc. Within the programme, 86 nurseries and 92 micro-nurseries have been established. The goal is to plant 17 million fruit and timber trees by the year 2000. In 1997, 5 million trees had already been planted by 5,120 grassroots projects (Agropecuario 1997).
All these trees have secondary benefits such as edible fruit, fuel for cooking or wood for construction. The programme has been promoted in order to increase urban biodiversity and options for food production, as well as to encourage citizens to take personal responsibility for the reforestation of the city. The policy is to also ensure high permanent fruit yields in the city.

6.2 Animal production

Regulations exist to ensure that pig production does not take place in areas where it is likely that local populations are affected, or where water supplies can be contaminated. Pig farming is found mainly on the fringes of the city. There are 63,000 pigs, of which 68% are privately owned. The producers formed a partnership with an outlet company.

In Havana, 700 rabbit-rearing units can be found with 3,500 female rabbits. Residents directly raise 170,000 birds through the urban agriculture program. Sheep and goats are also kept, not only for their meat, but – more importantly – for their milk, frequently used in prescription diets.

Manure is used mostly as fertiliser. There are also some biogas systems operational, whereby on-farm gas for cooking is obtained from manure before it is used as fertiliser.

7. Support services

Urban citizens do not become experienced gardeners overnight. Also the major change from agriculture based on high chemical inputs to low-input sustainable agriculture cannot be made without technical support. The surge of urban agriculture has been made possible by an impressive set-up of support organisations for producers. The role of the Urban Agriculture Department has been very important in facilitating the changes by, among other things, creating an extension network. Urban agriculture comprises 26,000 people and an integrated system organised by the municipalities, popular councils, research institutions, extension networks and service networks. Many women work as extensionists (45 out of 68), in the urban agriculture department (14 out of 30), in the agricultural store consultancies (32 out of 62), etc.

7.1 Extension network

Each municipality has an extension team of two to seven workers, depending on the size and number of gardens. In most cases, each extensionist works in a specific *consejo popular*. In total, 68 extensionists are now working on local community level, providing veterinary and phyto-sanitary services, and transferring technologies. They spend most of their time visiting the different producers in their area. They assist the farmers in monitoring crops, identifying pests and obtaining the necessary (biological) control products.

Another important responsibility of the extension agents is to distribute land to the growers. Local residents can request garden plots directly from the extension agent, who in turn is obliged to find a suitable plot and to secure the rights for the gardener. At harvest time, the extensionist issues a selling permit to the producer. In case the extensionist observes that a piece of land is not being made productive, s/he can ultimately, after some warnings, give the land to another producer.

The extension workers are also community organisers. Their role has been crucial in the creation and success of the *Grupos Horticultores*. The agents encourage producers to join the network and help with the integration of new members, the formation of new clubs, etc. Their work facilitates, in short, the grassroots level of the national transformation to a “new agricultural model” (Rosset & Benjamin 1994).

The extension agents also work closely with other institutes involved in urban agriculture - the agricultural stores, seed houses and agricultural research centres. In this way, the work of the different institutes complements each other. Educational workshops offered to both extension workers and city gardeners exemplify the co-ordination among these agencies. So far, over 30,000 people have gone through training sessions and seminars organised by extension services and research institutes in Havana (Paez 1998).

7.2 Agricultural store consultancies

Havana has 26 agricultural store consultancies *(tiendas agrícolas)*. Their role is to guarantee the technical and material viability of urban agriculture. The shops are found in urban areas and provide seed, seedlings, tree saplings, bio-fertilisers, bio-pesticides, soil conditioners and tools such as hoes, machetes, etc. The clients are given technical advice on agriculture and MoA publications can be found in the stores.

At first, the stores were run by employees of the MoA. In the general process of decentralisation, however, the employees became self-employed managers with a high degree of autonomy. The staff of the stores are well-qualified agronomists or other staff with substantial agricultural experience.

Originally, the distribution system from state suppliers to the stores was not perfect, forcing the stores to close at times, but the situation has been gradually improved. The prices are set by the stores, and their salaries are determined by the net profits.

7.3 Veterinary clinics

Before the development of urban agriculture, there was only one veterinary clinic in Havana. Today, there are nine clinics and, in addition, each community council has its own veterinary service. In total, there are 250 veterinarians, of whom 126 are women.

7.4 Biological Pest-Control Centres

The recent economic crises have deprived Cuba from attaining the foreign currency needed for importing the chemical products the country had formerly relied on so heavily. This accelerated the adoption and production of bio-pesticides. Eleven *Centros de Producción de Entomófagos y Entomopatógenos (CREEs)* provide services to all producers. The centres produce and supply bio-pesticides to the producers through the above-mentioned agricultural stores. As the city regulations do not permit the use of chemical pesticides, bio-pesticides are fundamental to the development of urban agriculture. Related to the CREEs is the phyto-sanitary service, which employs inspectors who are charged with the authority to fine any violation of the regulations.

7.5 Agricultural research centres

Cuba has a large agricultural research sector. The development of the urban agriculture sector has been supported by research and technical assistance of research institutes. It also should be noted that the curriculum of agricultural colleges has been adapted to the transformation of the agricultural sector, ensuring qualified researchers for the future. The Urban Agriculture Department has been working with all these institutes to determine how they can best serve the needs of city farmers (Iturriaga 1997). The institutes are increasingly working directly with urban gardens, providing resources and assistance. The institutes also disseminate research results, brochures, etc.

The National Institute for Basic Research in Tropical Agriculture (INIFAT) has been working most directly with urban farmers. INIFAT’s role in extension has become quite widely known among growers, and many now go directly to the INIFAT central headquarters for advice. INIFAT also co-ordinates a new network of 5 seedling nurseries in Havana. The seedlings and saplings produced are sold at prices lower than seedlings available form other places. Six more seedling centres have been planned. INIFAT stresses the importance of recognising local knowledge and learning from growers, not just teaching them.

Other institutes involved in the urban agriculture sector are the Plant Protection Research Institute (INISAV), which runs the 11 CREEs in Havana. All the representatives of the *consejos populares* and the extensionists have been trained in aspects of biological plant protection. The Institute for Research on Pastures and Forage (IIPF), Soils and Fertiliser Research Institute and the Rice Research Institute are also involved in urban agriculture. Each institute has a national plan as well as a plan for Havana, detailing concrete tasks and responsibilities.

8. Challenges for urban agriculture in Havana

The success of Havana’s urban agriculture very much depends on the supportive role of the Cuban Government and its direct involvement in resolving concrete problems. Co-ordination of access to resources, as happens in Havana, avoids strong competition for and speculation on resources, as is the case in many cities around the world. Urban agriculture in Havana has been benefiting from this, because land has been secured for productive use and production sites have been planned at suitable locations, for instance, near water sources. Nevertheless, resources are limited.

Water availability is a major issue for Havana's gardens. The national water network does not bring in sufficient water to satisfy all household needs. Recently, the local government restricted the use of urban water supply for agriculture, in order to conserve water for drinking, washing and sanitation. Alternative water sources for urban agriculture need to be found, together with methods to prevent water losses and to enhance soil moisture conservation. Some steps have been taken to solve the shortages, such as the micro-jet drip-irrigation systems which use water more efficiently. Also, more wells are being dug.

In urban areas, there is, of course, limited open space for agricultural production. In addition, open land often has extremely hardened soil, is full of gravel and has a low organic matter content. It demands much effort to bring these soils into production, and especially organic matter and compost[4] are needed in large quantities. In some areas with no topsoil, gardeners plant in 100% compost. The use of vermiculture is spreading, as well.

For historic reasons, there is a serious lack of diversity in seeds and crops. For example, there is only one kind of melon and one kind of squash available in Cuba. This lack of diversity has been addressed by the *popular gardens* and many rare crops are being brought back. This has been largely due to local seed saving, which allows the cultivation of locally-adapted crops and varieties that are suited to the particular conditions of a site. The Urban Agriculture Department has also offered a series of workshops for urban gardeners and extensionists on seed selection and saving.

9. Impacts of urban agriculture

Havana probably offers the most successful example for which the concept of urban agriculture was used as a response to a food crisis, not only by individual residents but also as a government-supported strategy. The easing of the worst impacts of the crisis is not bringing with it signs of abandoning urban agriculture. In fact, farms and gardens are steadily increasing in size and number. With

4 Compost is produced mainly from the residue of sugarcane production *(cachaça).*

experience rising, not only the production has increased, but the quality has improved as well.

9.1 Food security

It has only been a few years since Havana was consuming large amounts of food that was barely produced domestically. Thanks to urban agriculture, the city has become one of the largest producers of vegetables in the country, demonstrating the enormous potential of urban agriculture in Havana.

Urban agriculture has had a dramatic positive impact on the deteriorating food situation in Havana during the “special period”. The urban gardens were central to mitigating the food crisis. Urban production is not enough to provide for all food needs in Havana, but it has contributed to the amount of food available. Its increased local self-sufficiency has made food cheaper and more easily accessible, for instance, by reducing the time needed to buy food. Today, some neighbourhoods produce up to 30% of their food supply (Sanchez 1997). Urban farmers, on average, sell their produce 20% cheaper than mainstream market traders and effectively counter excessive price increases. Because the produce is bought on the spot and no storage and transport are needed, post-harvest losses are lower as well.

As mentioned above, neighbourhood gardens regularly donate food to schools and daycare centres. In an attempt to promote better eating habits and improve nutrition, production units are linked with youth groups and schools. Thus, urban agriculture also improves the quality and variety of food consumed. Havana's residents are now eating more fresh vegetables than before the “special period”. In addition, the popular gardens enhance cohesion and solidarity in the neighbourhoods.

9.2 Employment

The development of urban agriculture has created new employment opportunities – an important aspect, since the crisis reduced jobs significantly. Overall, the Government estimates that 117,000 people work in urban agriculture and 26,426 workers are employed in jobs related to urban agriculture. In 1998, urban agriculture accounted for 6-7% of the new jobs. The household income of many people working in urban agriculture is actually higher than the national average salary.

9.3 Environment

Originally, urban agriculture was not specifically aimed at improving the environment. Havana is not without its environmental problems, but the city does not face such grave environmental problems as do other large cities. Over time, however, the ecological aspects of urban agriculture have been appreciated by the Cuban Government.

The integrated approach has helped to avoid many of the problems associated with urban farming in other cities. For example, the use of toxic agricultural chemicals is banned. This ban was facilitated because the research institutes, internationally renowned for their achievements, were able to produce biological control methods, both for control by insects, fungi and bacteria as well as organic control by plants with insecticidal properties, such as neem **(??)** and tobacco.
Instead of hindering urban planning, urban agriculture has become an important component in urban development. The Department of Urban Planning together with the Department of Urban Agriculture developed zoning plans for allocating land suitable for farming. Potential health hazards associated with raising animals are thus avoided. For example, the rearing of pigs is located in the urban periphery with strict sanitary management and veterinary control, and certain agricultural activities are banned close to water sources. Another example of co-ordination is the involvement of the Ministry of Public Health in mitigating health risks related to animal keeping.

Daily, the city produces 1,400 tons of solid waste from residential areas. Part of the waste is recycled in the newly created centres for producing compost. In total, about 25 units are in place in Havana for the recycling of urban organic waste.

An extra contribution to the environment by urban agriculture is the reforestation programme (*Mi Programma Verde*). The net environmental impact of urban agriculture thus has been positive, contributing to increasing the greening of urban wasteland, improving water retention, improving the air quality and beautifying the urban landscape.

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Appendix 1: ***Main crops grown in Havana***

Vegetables	**Fruit**	**Tubers / roots**	**Legumes**	**Other**
Beets	Avocado	Cassava	Pigeon pea	Rice
Cabbage	Banana	Sweet potato	Black beans	Sugarcane
Celery	Plantain	Taro	Red beans	
Chard	*Chirimoya*		Soybeans	
Chives	Coconut		Chick peas	
Corn	Grapefruit			
Cucumber	Grapes			
Eggplant	Guava			
Garlic	Sour orange			
Green Bean	Soursop			
Lettuce	Lime			
Okra	Mandarin			
Onion	Mango			
Peanut	Mamey			
Pepper	Cantaloupe			
Radish	Orange			
Spinach	Papaya			
Squash	Pineapple			
	Passion fruit			
	Tamarind			
	Tomato			

Source: own findings 1998

WASTE RECYCLING THROUGH URBAN FARMING IN HUBLI-DHARWAD

Fiona Nunan

1. Introduction

Urban agriculture in India is strongly characterised by tradition and links with rural areas. Whilst in some metropolitan cities, low-income communities are growing vegetables on small plots of land, by far the greatest amount of urban agricultural activities involve keeping livestock, particularly in urban dairies. Urban and periurban agricultural activities in India are particularly associated with urban-based sources of waste, both in terms of consuming waste and producing dung. As noted by Furedy and Whitney (1997: 2), "food production using wastes is a widespread tradition in Asian cities".

The population living in urban areas in India is increasing. The population of India is over 850 million and, in 1991, at the time of the last census, 26% of the population was living in urban areas. The urban population of India is forecast to be over 300 million, 30.4% of the total population by 2001, and to rise to 50% of the population by 2025. The number of urban areas has also increased, from 4,029 in 1981 to 4,689 in 1991, and the number of urban agglomerations increased from 3,378 in 1981 to 3,768 in 1991.

Visitors new to India cannot fail to notice the number of livestock in cities and towns, particularly roaming cattle. Pigs and donkeys can also be found roaming freely, and herds of buffaloes and flocks of sheep and goats are led through urban areas on their way to grazing land. Animals left to roam do have owners and return to particular areas, or are fetched by their owners when evening arrives. Cows have a particular importance in Hindu culture and are considered to be sacred.

There are many reasons why livestock can be found in such abundance in most urban centres of India. Tradition is one reason, particularly in the case of buffalo keeping, but also urban centres provide a number of incentives for keeping livestock. These include sources of fodder, such as food waste from hotels and vegetable waste from markets and homes, and easily accessible markets, particularly for fresh milk from urban dairies. Dung from cows and buffaloes is sold to farmers near to the city and is used or sold as fuel for cooking. Traditionally, there have been far more buffaloes than cows in urban centres, as most people prefer buffalo milk, which is richer than cow's milk, and is better for preparing ghee (similar to butter) and curd. Urban and periurban agriculture provide income-generation opportunities for urban dwellers. Many urban centres in India have maintained strong links with rural, and hence agricultural activities, so that livestock keeping is common and urban dairies are the norm.

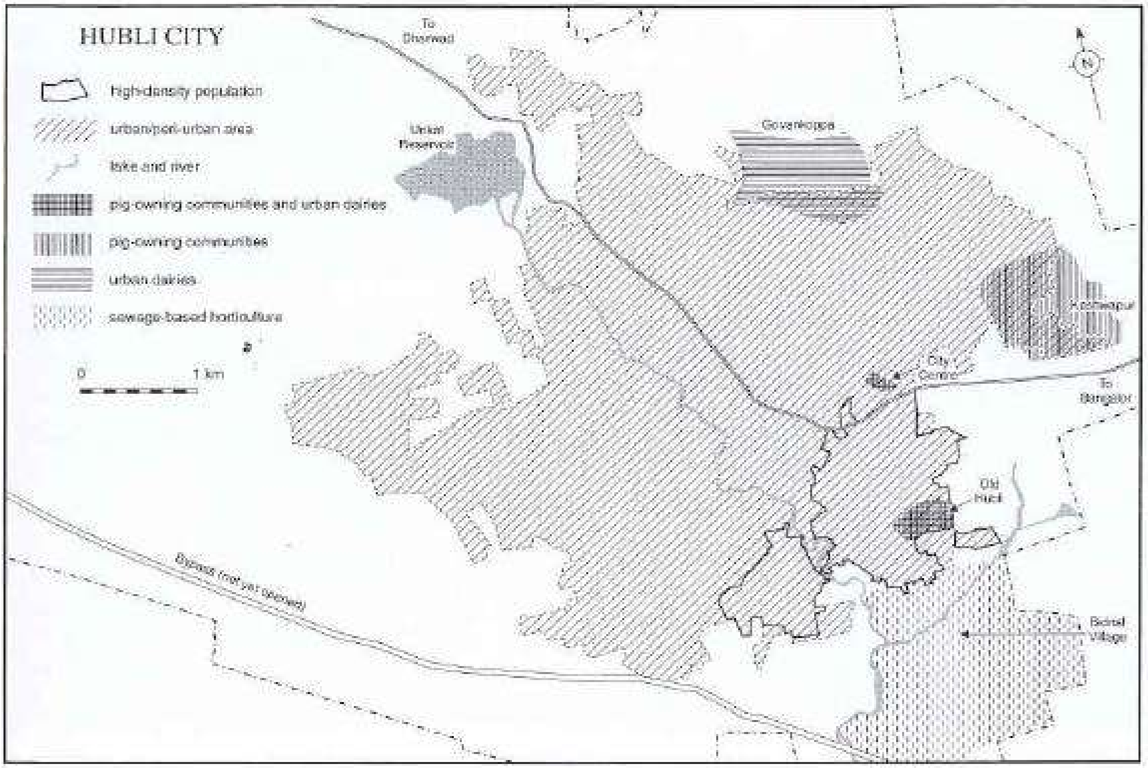
Growing fruit and vegetables is not common in urban centres across India, though there are increasing trends towards middle-class households cultivating small amounts of fruits and vegetables. There is also anecdotal evidence of poorer communities living in slum areas of metropolitan cities, such as Mumbai (formerly Bombay) and Calcutta, growing vegetables alongside railway tracks and in small patches of open land. A lack of space and poor access to seeds, composts/fertilisers and water are constraints to urban vegetable farming; moreover, people have little time outside paid work and other household duties.

It is possible that the number of livestock kept in urban centres will decrease because of increasing complaints from residents about offensive smells and potential health hazards, increasing motorised traffic in urban centres, decreasing availability of accessible grazing land, more competition for fresh milk from packaged milk and increasing requirements for local authorities to take action to reduce environmental problems. In turn, in the larger metropolitan cities, like Mumbai, Calcutta and Delhi, the size of the cities, increasing land values and traffic congestion make access to markets for small producers more difficult. This may lead to increasing amounts of vegetables and fruit grown within the urban boundaries, particularly by poorer communities.

In Hubli-Dharwad, many urban dairies continue to operate, pigs roam freely, much to the consternation of many residents and the Municipal Corporation, and periurban agriculture uses many sources of urban waste as soil conditioners.

2. The twin-city of Hubli-Dharwad

Hubli-Dharwad is a twin-city in the north of the southern Indian State of Karnataka, with a population of approximately 800,000. In 1991, Hubli-Dharwad was ranked 44th among India's 308 urban agglomerations. There are two urban centres, separated by about 20 km along National Highway 4. The area that separates the two urban centres, known as Navalnagar, was designated a new settlement to link Hubli and Dharwad in the 1970s. This area has a main railway line and a variety of non-agricultural activities are being developed along it, including industries, offices, warehouses and residential areas.


HUBLI CITY
high-density population
urban/peri-urban area
lake and river
pig-owning communities and urban dairies
pig-owning communities
urban dairies
sewage-based horticulture
0
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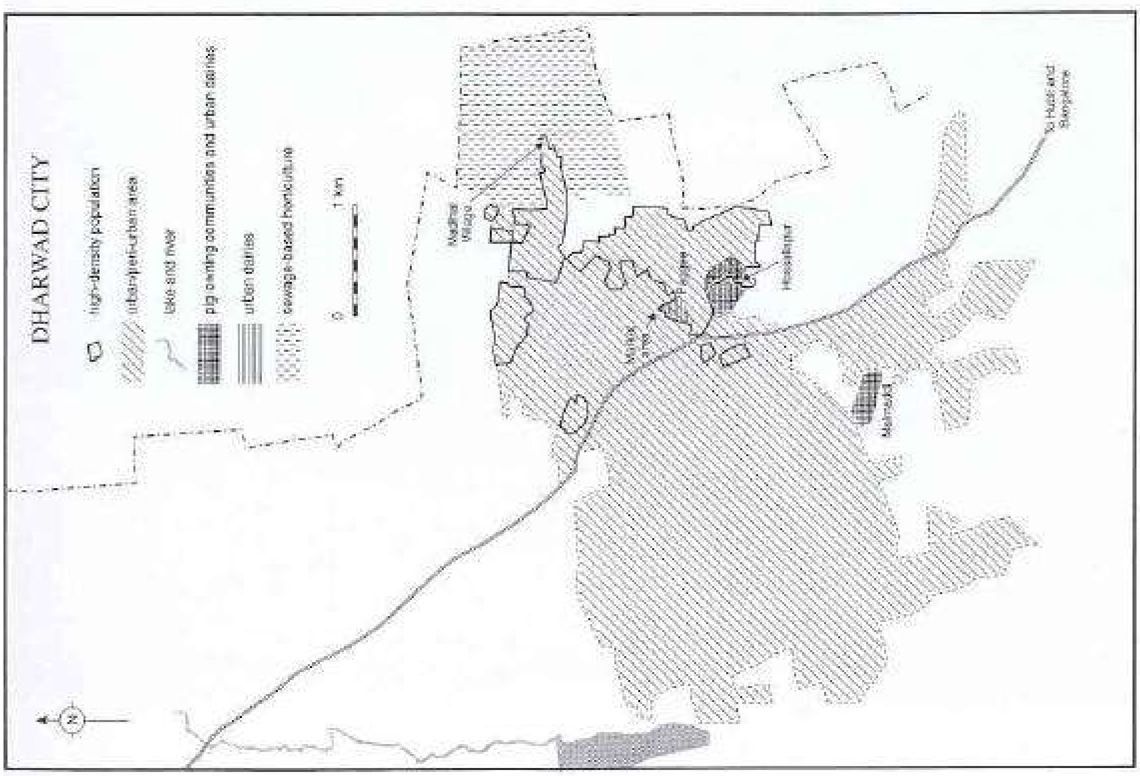
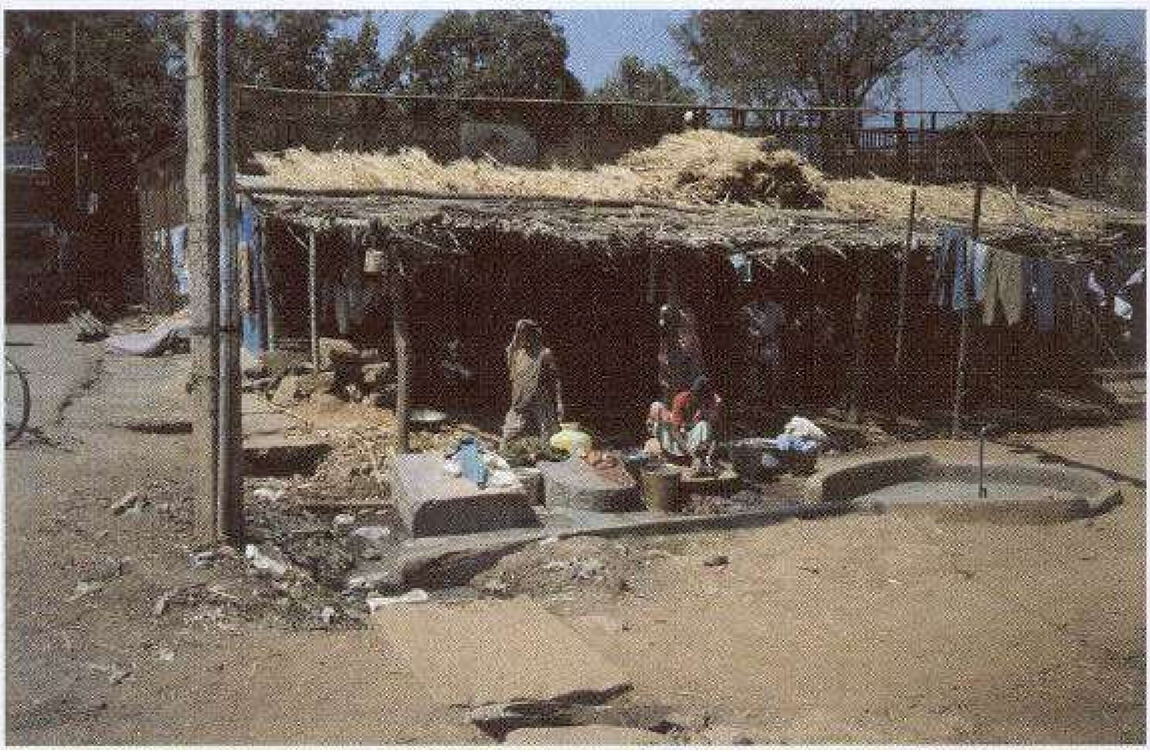
To Dharwad
Unkal Reservoir
Govankoppa
City Centre
Old Hubli
Bidnal Village
Bypass (not yet opened)


DHARWAD CITY
high-density population
urban/peri-urban area
lake and river
pig-owning communities and urban dairies
urban dairies
sewage-based horticulture
0
1 km
To Hubli and Bangalore

Cows feeding from a Municipal Corporation bin (Picture Fiona Nunan)



The twin-city is in Dharwad District, which, after re-organisation in 1998, has five *talukas*, or subdistricts. It is the second largest city in Karnataka, after Bangalore, the State capital. The twin-city is administered by the Hubli-Dharwad Municipal Corporation (HDMC), which provides the cities' infrastructural services, including water supply and solid waste collection and disposal. The Hubli-Dharwad Urban Development Authority (HDUDA) is charged with implementing the Comprehensive Development Plan, regulating development activities and providing new residential layouts. The two cities provide quite different services, Dharwad has more education institutes and houses the district headquarters, and Hubli is a more industrial and commercial centre. The twin-city therefore has two hubs, which are quite different in nature, with Dharwad having a lower density of population and more open spaces than Hubli.

From 1981 to 1991, Hubli-Dharwad achieved a modest population growth. In 1981, the population was 527,108, rising by 23% to 648,298 in 1991. This was lower than the average growth rate of 36% over the decade for the 21 urban agglomerations in Karnataka State and the national growth rate of 37% of the 308 Indian urban agglomerations. The twin-city covers an area of 191 km^2, of which around 40-45% of the conurbation land was developed in 1991. The population has risen in the late 1990s to around 800,000, and the density is now around 4,180 persons/km^2, but still far below the average for Karnataka of 4,985 persons/km^2 and the Indian urban agglomeration average of 5,953 persons/km^2.

Table 1: ***Comparison of urban characteristics of Hubli-Dharwad with India***

	India	**Hubli-Dharwad**
Population	850 million	648,298
Urban agglomeration Growth: 1981-1991	37%	23%
Density	5,953	3,395

Source: 1991 census data

In 1981, there were 52 notified slums in the city and slum dwellers represented 8.68% of the total population. Figures from 1998/99 indicate that the number of slum areas has slightly decreased, with 31 identified and registered slums in Dharwad and 15 in Hubli. The number of people living in slum areas has, however, increased by 17.55% to 16,738. The slum population does not account for all households living below the poverty line. Indeed, it has been suggested that more than 40% of the urban poor do not live in slum areas in India (Shepherd et al. 1998). There are, at present, no other indicators of the location of poor households within Hubli-Dharwad. However, research does indicate that, in India, the urban poor are characterised as having casual employment or self-employment in the informal sector, and that poverty amongst female-headed households is more serious within urban areas than rural (Shepherd et al. 1998). This raises food-access issues and the potential of urban agriculture to address the food security of the urban poor.

The region is semiarid and most agriculture is rainfed. The lack of irrigation facilities influences decisions made regarding crops grown. Mango orchards are seen, for example, as a good investment partly because only a small amount of irrigation is required once the trees are established. The adoption of sewage-based horticulture is one response to the inadequate supply of irrigation facilities around the city.

2.1 Urban employment in agricultural activities

Involvement in agricultural activities ranges from gaining casual work in the urban and periurban areas during peak seasons of demand, such as weeding and harvesting, to owning a dairy within the city. Agricultural activities were categorised as “cultivation”, “agricultural labourer” and “livestock farmer” in the 1991 census. On account of the size and nature of Hubli-Dharwad, some residents rely exclusively on agricultural activities. There is no information in the census data regarding income groups within the agricultural sector, though it is likely that most, if not all, agricultural labourers are lower-income people and many of these are women. The urban female workforce involved in urban agricultural activities was 20% in 1991, compared to the urban male figure of 11%. This represents a significant gender difference in terms of reliance on urban agriculture as a source of income generation.

There may be other factors that can account for the reduction in the number of people relying on agricultural employment within Hubli-Dharwad. Mechanisation is increasing in the villages surrounding the city, reducing farmers’ recruitment needs; the city has grown, taking up agricultural and grazing land; and the density of the population in the city cores, particularly in Hubli, has increased, reducing the scope for keeping livestock in the city centres.

3. Urban agricultural activities

There is no official definition of urban agriculture within Hubli-Dharwad, or recognition of its role in contributing to food security and livelihoods. The lack of recognition is largely due to the unofficial nature of urban agriculture and the fact that the authorities within the urban area are not charged with promoting or facilitating agricultural activities in the city.

Many aspects of urban agriculture are seen as a nuisance and something to be stopped.

The lack of official interest in agricultural activities taking place within urban areas means that there are no records of production levels within the city. Agricultural, horticultural and dairy production figures are recorded only for the district as a whole and it is very difficult to get a breakdown of production levels according to villages or distances from the city. Horticultural products brought to the city for sale are not traced according to where they come from and production figures for vegetables irrigated by wastewater are not available.

The term "urban agriculture" is used here to refer to agricultural activities within the core of the urban areas and, in the case of Hubli-Dharwad and most other cities of India, this refers almost exclusively to cattle, buffalo and pig keeping. Agricultural activities close to the city which have strong links with urban areas in terms of investment, labour, markets and inputs (including organic waste) are referred to as "periurban agriculture". For Hubli-Dharwad, this includes horticulture, particularly using sewage-based irrigation, sheep and goat herding, dairies and poultry units. Staple food crops are also grown close to the city and many have strong links to urban areas, particularly in terms of using local markets and buying municipal solid waste and manure from urban dairies. Periurban farming tends to be more commercial, as suggested by the Food & Agriculture Organisation (FAO) definitions of urban and periurban agriculture (FAO 1999).

Many of the agricultural activities undertaken within the urban and periurban areas of Hubli-Dharwad are traditional activities, passed on from one generation to the next. This is particularly the case with livestock keeping, with buffalo and pig owners coming from families that have kept livestock for many generations, often within the urban area.

3.1 Urban dairies

In and around the city there are large and small dairies, with the more commercial dairies (about 20 in number) keeping between 10-20 buffaloes and crossbred cows. Several smaller dairies keep crossbred cattle, but by far the largest number of urban dairies belong to traditional buffalo keepers, known as *gowlies*. Such buffalo keepers may rely on more urban-based work, but keep one or two buffaloes as a source of milk for their family, as an additional source of income, and because they want to keep to tradition and provide a source of security. There are, however, households that rely solely on the milk produced by buffaloes as their source of income.

In Dharwad, there are several areas where buffalo keepers reside. These include the Paggee area, right in the core of the city, where there are approximately 50 gowli families, Hossallapur and Malmaddi, where there are 150 and 150-200 gowli households, respectively. In Hubli, the situation is more complicated because of the density of city. There are fewer areas within the core of the city where buffaloes are kept, though there are a few sheds opposite the Telegraph Office, which is fairly central. Most other gowli families live on the outskirts of Hubli, for example, in Govankoppa, where there is easy access to grazing land.

The cattle and buffalo populations within Hubli-Dharwad, are high for an urban area.[1] As might be expected from the description of Hubli being a more commercial centre than Dharwad, there are fewer cattle and buffaloes than in Dharwad, though slightly more crossbred cattle. The number of livestock in a location is, of course, a moving target, as more are born and are brought into the area, whilst others die. Table 2 confirms an expected trend: the number of cows and buffaloes are decreasing in the city, though the reduction in the number of crossbred cows seems surprising, if larger, more commercial, urban dairies are opening within the city boundaries. This may, however, be a very recent trend.

Table 2: ***Cattle and buffalo population in Hubli-Dharwad***

Type of animal	**1990**	**1997**		**Total for 1997**
		Hubli	**Dharwad**	
Local cattle	11688	3237	5578	8815
Crossbred cattle	2192	417	238	655
Buffalo	9658	3125	3824	6949
Total	**23538**	**6779**	**9640**	**16419**

Source: Livestock census figures[2]

Gowlies sell milk directly to hotels and boarding houses at a price based on the total solids, and to households either from headloads or in cans mounted on bicycles or mopeds, at around Rs10[3] per litre. Some gowlies milk the buffaloes in front of the consumers, to assure them of the freshness of the milk and that it is not adulterated. Consumers sometimes give loans to gowlies for the purchase of buffaloes, with the loan repaid by taking milk. Milking buffaloes in front of customers is also carried out, for example, in one area of Hubli, where buffaloes are taken to a common area at fixed hours in the morning and evening. The vendors milk their animals two or three times in a span of one or two hours as and when customers visit to purchase milk. A premium price is paid for such fresh milk.

The main source of fodder for urban dairies is from the adjoining rural areas, where sorghum is grown extensively. Dry fodder is sold for around Rs 10-15 for a bundle of sorghum stalks. The urban dairies purchase fodder during the harvest season and store it for use during the year. Grasses are also grown and brought to Hubli-Dharwad for sale as fodder. Bundles are sold for around Rs 5-10 for 15-25 kg. The owners of large urban dairies have their own resources for growing fodder, including cereals, legumes and fodder grasses. Additionally, food waste from hotels and cafés and vegetable waste are fed to the buffaloes.

There are a number of constraints to keeping buffaloes and cows within the urban areas. These include the lack of space, particularly within the core of Hubli city, which is more congested than Dharwad, declining access to grazing land and to drinking and washing water, and a decreasing supply of fodder, as more land around the city is taken for residential, commercial and industrial development. Livestock owners within the city can access veterinary care for their animals. One of the main problems of keeping cows within the city and allowing them to roam freely for food is the ingestion of "foreign objects", from hairpins to coins. Such objects pose a considerable hazard to cattle, and possibly to pigs, though pig owners find it more difficult to access veterinary care.

3.2 Urban scavenging pigs

Hubli-Dharwad has a significant number of scavenging pigs. These are owned by a number of quite distinct communities within the city. These include the Hindi *gollar* communities and the Bhils community from the Punjab, whose main occupation is turning scraps of metal into utensils. The keeping of pigs in Hubli-Dharwad has been under threat from the Hubli-Dharwad Municipal Corporation. In response to complaints about roaming pigs and potential health threats, the Corporation has been rounding up pigs and sending them out of the city, to a forest area around 10 km away. The pig owners believe it would be too expensive to keep the pigs penned in and bring feed to them.

As with buffalo keeping, pig owning is a tradition, handed down from generation to generation. Pig-owning communities can be found in several areas of Hubli-Dharwad. Within Dharwad, such communities live in areas such as Malmaddi, Saraswatpur and Hosallapur. Many buffalo owners also live in Malmaddi, and the dumpsite is located in Hosallapur area. In Hubli, the locations include Old Hubli, the Settlement (locally known as Setalment) area and Keswapur. Again, buffalo owners and even sheep and goat herders can be found in similar areas, particularly Old Hubli. The locations may be due to tradition, but also proximity to areas where pigs can roam for food.

The Livestock Survey conducted in 1997/98 estimated the number of pigs to be 1,473 in Dharwad and 2,254 in Hubli; in 1990, the figure for the twin-city was only 839. However, more realistic estimates put the figure at around 20,000, which roam in herds of between 10 and 500 pigs. The underestimate of the official figures may be due to the owners themselves not knowing the actual number of pigs in their herd, as this can change from day to day. Owners may also be afraid of admitting the real number of pigs owned. Pigs are not welcome in the cities, despite the service they provide in consuming organic waste and excreta.

Pigs represent a source of cheap protein for certain social groups which consume pork, as they rely on low-cost sources of feed – street rubbish, waste from hotels and restaurants, soil and vegetation. Pigs are sold for Rs 15-20 per kg liveweight and Rs 35-50 per kg pork. The pigs, or pork, are transported to the consuming markets in Goa and at Hassan, Mangalore and Bangalore, in Karnataka.

3.3 Sheep and goats

The keeping of sheep and goat is confined to the outskirts of the twin-city. These animals are often kept by people who migrated from villages to the urban areas. There are far more goats than sheep in Hubli-Dharwad. Goats are easier to feed. They eat the loppings of trees, for example, the remains of which are taken by herders for use as fuelwood.

Table 3: ***Sheep and goat population in Hubli-Dharwad***

	1990	**1997/98**		
	Hubli-Dharwad	**Hubli**	**Dharwad**	**Total**
Sheep	558	696	1192	1888
Goats	4139	1266	2417	3683

Source: Livestock census figures

According to the figures from the Livestock Surveys, the number of sheep kept within the city boundary has risen dramatically during 7-8 years, whilst the number of goats has fallen. The availability of grazing land may affect the population of sheep within the urban boundary in the future, as may the availability of other employment opportunities. The access to markets, selling sheep directly to consumers, may also provide some explanation for the increase in their numbers.

3.4 Horticulture

The area given to horticultural crops within the periurban areas of Hubli-Dharwad is increasing. There are, however, a number of constraints to the cultivation of horticultural crops. These include the lack of irrigation water and the lack of storage facilities for the produce within the urban area. The lack of irrigation facilities is partly overcome by the use of sewage water flowing within streams, from both Hubli and Dharwad, which is particularly useful, as installing borewells is expensive. The lack of storage facilities means that good access to markets is critical.

Small producers within 7-10 km from the cities carry small quantities of produce by headloads and sell directly to consumers in the fruit and vegetable markets. Those within a distance of over 10 km carry their produce in carts, or travel by bus or train, and sell to wholesalers in the urban area. Farmers may also belong to the Karnataka Horticultural Producers Co-operative and Marketing and Export Society in Hubli. This organisation has members from throughout Dharwad and Bijapur (further north in Karnataka) Districts and sells produce on behalf of their members, at no cost, though a deposit is paid by members and profits are shared between members.

Horticulture has increased in area and number of crops, where wastewater from Hubli-Dharwad can be used to irrigate crops. This is a key example of the flow of waste from urban to rural, and the reciprocal flow of fruits and vegetables to the urban area.

3.5 Sewage-based farming systems

As there are no sewage treatment plants in Hubli or Dharwad, the sewage flows out of the urban areas in pipes, which eventually feed into streams. Around 60 million litres of wastewater are generated in the twin-city per day (Hunshal et al. 1998). The sewage is used by farmers for irrigation, by installing pumps on manholes. The water is generally used for horticulture. The wastewater is used in areas around Hubli including Bidnal, Gabbur, Old Hubli, Budarasingi, Mavanur, Katnur, Giriyal, Balagah and Veerapur. Some of these villages are up to 30 km from Hubli and many farmers feed pipes for a few km to use the wastewater. Around Dharwad, the untreated sewage is used by farmers at Madihal and Hirekeri to grow vegetables, *jowar*, groundnut and chillies.

Vegetable plots tend to be small, typically 0.6-0.8 ha, but they are intensively cropped, with 4 or 5 crops a year. The vegetables grown include cauliflower,

cucumber, beetroot and spinach beet. It is estimated that yields with the use of sewage water are 25-50% better than crops grown with water from borewells (Hunshal et al. 1998). Other than the increase in yields, farmers also benefit from having to rely less on erratic rainfall, providing greater security. Farmers are able to take advantage of the number of crops grown throughout the year by charging more during off-season periods (Hunshal et al. 1998). The wastewater from the two cities is also often used to wash vegetables in the market places, as the outlets form the most convenient source of water in the market areas. This practice may further contribute to health concerns over consuming sewage-irrigated vegetables.
The amount of chemical fertiliser needed is low, though the amounts of herbicide may increase, on account of prolific weed growth. The increase in the number of weeds may be due to the fertile nature of the sewage water, but may also simply be due to the increased availability of water in areas that were traditionally rainfed. The increase in the number of weeds also has implications for the labour requirements of a farm, adding to either direct costs of hired labour or opportunity costs of household members.

Farmers using sewage water should pay the Corporation Rs 50 a year, but most farmers do not pay the charge, even though they would recognise that this is a very low charge. If treated sewage water becomes available in the future, some charge will have to be levied to contribute to treatment and distribution costs.

There are health concerns about consuming such produce. Although there does appear to be a higher incidence of some heavy metals, such as iron, copper and zinc in gourd, mustard, spinach, cauliflower and radish, the findings were not linked to health impacts. The concentration of lead in produce was, however, found to be above critical limits in studies in Calcutta, raising concerns about the consumption of sewage-irrigated vegetables. Other problems resulting from the use of sewage irrigation include weeds becoming mixed with herbs when sold in the markets, dark roots on produce and, as a result of continuous irrigation, the soil is becoming increasingly saline (Hunshal et al. 1998).

Although it is not clear that farmers are very concerned about potential health effects of using sewage water for irrigation, it is clear that there are potential problems. The health of the labourers working in the fields is of most concern, firstly due to pathogens in the wastewater, but also due to the increased use of pesticides, particularly if protective clothing is not worn. There are additionally concerns for consumers, in terms of residual pesticides in the produce and the existence of pathogenic microbes, as well as heavy metals.

It is very difficult to research the potential health effects of working with wastewater, as allowing for many other factors, such as income, housing and genetic factors, makes epidemiological studies fairly complex. A small study was conducted in Madihal, near Dharwad, and in Hale Gabbur, near Hubli, to look into the health effects on farm labourers. There did appear to be a high incidence of skin diseases in the sample studied, but the study was too small for significant conclusions to be drawn. Furedy and Whitney (1997:8) acknowledge the difficulty of conducting epidemiological research, as the workers most at risk "live in poor sanitary conditions and may be malnourished as well".

3.6 Rural-urban linkages

Rural-urban linkages in the Hubli-Dharwad city region include: investments in mango orchards by urban dwellers to reduce tax burdens; increased opportunities for marketing of produce through the use of bus and train routes; fodder brought into the urban areas for livestock; and the potentially conflicting demands for urban wastes for use as fuel sources and as a soil conditioner. The cycle of nutrients through the use of urban waste in agricultural activities has long been a key example of urban-rural linkages within Hubli-Dharwad, as in many other city regions of India. There are well-established, though informal, markets in urban waste.

Rural-urban linkages are a crucial part of urban and periurban agricultural activities undertaken in Hubli-Dharwad. The flows of fodder, wastes, labour and investment between the rural and urban areas form a critical component in maintaining food security and livelihoods within the city region. Many of the flows exist because of inadequate enforcement of legislation and a lack of environmental services. Such flows include the sale of sewage that has filled a recreation tank in Dharwad, the sale of market waste to farmers (waste that should belong to the Municipal Corporation) and the sale of municipal solid waste, which reduces the amount of waste in the dumpsites.

Table 4: ***Rural-urban linkages within the Hubli-Dharwad city region***

Linkage	Examples
Natural resource-based commodities	• commercial mango production very close to the city for national markets; • declining flow of fuelwood; • increased bus- and train-based small-scale supply of fruit and vegetables to the city; • fodder brought into the city for cattle and buffaloes.
Labour	• development of bus-based intensive commuting up to 20 km; • shortage of labour for agriculture: failure of agricultural wage levels to adjust, hence extreme inequality and significant level of absolute poverty.
Investment	• speculative, unevenly distributed land purchase process; significant variation in land value trends; • land purchased for mango production to avoid taxes; • increased use of (often toxic) agrochemical inputs for agriculture; • increasing mechanisation and replacement of buffaloes/draught cattle; • privatisation of common land.
Energy	• declining local energy production; compensated by increased inflow of liquid petroleum gas (LPG) and subsidised electricity; • limited scope for renewable or decentralised energy because of subsidy structure and scarcity of recyclable waste materials.
Waste	• wastewater increasingly used for high-value crop production: increased pest and weed problems observed; • dung sold by urban and periurban dairies, poultry units and sheep and goat herders to farmers; • slaughterhouse waste, municipal solid waste and market waste sold to urban farmers.
Water	• urban tanks in decline; increased use of groundwater, especially in periurban areas; • some danger of aquifer pollution from sewage system; • urban sewage polluting streams; • demands for more reliable water supplies in the urban area and potential conflicts with demands for more irrigation facilities.

Source: Adapted from University of Birmingham et al. 1998a.

4. Food security, nutrition and health

The main reasons for keeping livestock in urban areas include generating income, keeping animals as an economic asset and having access to dung as a source of fuel. The contribution to food security appears to be limited. The contribution to income generation is illustrated by selling milk and sheep to local markets, and pigs to markets in other parts of Karnataka and in other states.

Production data is recorded only at district level, and this may well miss out small-scale production, where milk is sold to neighbours, often in small quantities. Although there are data on the number of livestock within the city during the time of the censuses, the figures do not say whether all buffaloes and cows are producing milk, and these figures would be subject to change within a short period. There is, additionally, seasonal variation, with buffaloes and cows producing more milk during the rainy season, when there is good grazing land available.

From the data given in Table 2, it is possible to estimate the contribution of urban dairies to the milk supply of Hubli-Dharwad. According to the livestock census of 1997, there were 16,419 cows and buffaloes in the city, of which around half may be lactating. There are variations in milk production between cows and buffaloes (with cows generally producing more) and between seasons. One could estimate that, on average, each animal produces 3-6 litres a day. This would produce between 24,630 and 49,260 litres, or 0.03- 0.06 litres per person. The 1990 livestock census data would give figures of 35,307 and 70,614 litres a day. The population of Hubli-Dharwad in 1991 was 648,298, suggesting that production levels would be around 0.055 and 0.11 litres per person. These figures are quite low, suggesting that milk imported from rural areas via the Karnataka Milk Federation dominates the urban milk market.

The consumers of milk produced in the urban area come from a wide range of areas. They include low-income consumers who purchase small quantities, but also middle-income households, who may prefer the richer buffalo milk to the treated and packaged milk, and who may purchase milk as a tradition, buying from the same family from generation to generation. Very few households within Hubli-Dharwad have refrigerators, so they want to store milk for only a short period of time. The delivery of milk twice a day by gowlies helps to ensure that milk is fresh and safe.

There does not appear to be evidence that urban agriculture substantially improves access to food in Hubli-Dharwad for the very poor. There may, however, be some slight improvement in nutritional status on account of the presence of small urban dairies, where small quantities of milk can be purchased, or perhaps even exchanged for other produce or services. Households with one or perhaps two buffalo must also benefit nutritionally, providing the buffalo is lactating. It appears that poorer households keeping buffaloes sell more of the milk produced and keep back less for home consumption. It could well be that opportunities for increasing access to food through keeping livestock may be offset by the need to obtain as much income as possible to buy other food, and non-food, items.

The use of sewage water in irrigating vegetable crops undoubtedly increases the area given to horticulture. Without the use of sewage water, and with no replacement of such a source of irrigation, the cultivation and availability of vegetables would decrease. Sewage-based horticulture is, therefore, an important source of produce and nutrients within the city.

There are a number of health risks associated with urban and periurban agricultural activities in Hubli-Dharwad. These include the use of untreated wastewater, posing health risks for farm labourers and, potentially, to consumers, the use of municipal solid waste as a soil conditioner, which may include pieces of glass and some hospital waste, and roaming pigs, which are perceived by some to pose a threat to health, though this is unsubstantiated in Hubli-Dharwad.

5. Urban agriculture and the urban environment

The relation between urban agriculture and the urban environment is most pronounced in the generation and use of organic wastes. The effects on the soil from using sewage water should not be detrimental with respect to heavy metals, as there are few significant industries within Hubli-Dharwad, and industries may not have access to the underground drainage system anyway, as it does not cover the entire city. There are a number of other sources of organic waste utilised by urban and periurban farmers, municipal solid waste and animal dung being the two key sources of urban waste.

5.1 The use of urban organic wastes

Different types of organic wastes play a key role in urban agriculture. Organic wastes from hotels, cafés and markets are fed to animals, which roam freely, consuming waste around municipal bins and in the market places. Wastewater is used by farmers on the outskirts of the cities, mainly to grow vegetables for the local markets. Municipal solid waste is sold to farmers near the cities for use as a soil conditioner. Other sources of urban waste sold to periurban farmers include market and slaughterhouse waste, and sewage waste, which is collected in a recreation tank in Dharwad. This is collected by nearby residents and sold to farmers, providing a source of income to low-income households, though the Corporation does have plans to restore the tank. The sale of decomposed sewage waste from underground drainage pipes is another example. Finally, livestock manure is stored in urban areas and sold to farmers, providing a source of income to the livestock owners and another source of organic matter for the farmers, which is often in short supply.

There are a number of advantages for the Municipal Corporation arising from these informal waste markets. These include the removal of much wet organic waste from the streets and bins, the revenue from selling waste, which, in turn, creates more space at the dumpsites, and the use of dung as a cooking fuel, reducing the demand for fuelwood and liquid petroleum gas (LPG). Although animals in the urban area do contribute to hazards, they serve a useful role in solid waste management.

5.2 Water

The number of lakes, or tanks, within the urban area has declined over the last twenty years. The water supply to the city is constrained by electricity (for pumping the water out of the reservoirs) and water shortages. Water is generally pumped into the city only every three days, and, then, only for a few hours at a time.

Some areas of the city are served by borewells, of which there are around 800, about half of which have potable water.

The reduction in the number of tanks in the urban area must have affected the number of livestock maintained, as tanks are crucial for watering and washing buffaloes and cows, particularly for owners with a small number of livestock. In terms of time and availability, it may be difficult to obtain adequate amounts of water from public taps and borewells. It is likely that the declining number of tanks has affected the microclimate of the area.

6. Contribution of urban agriculture to the household economy

Urban agricultural activities contribute to employment and income, and save resources in terms of purchasing milk, in particular. Being located in urban areas, there are greater opportunities for other work, though some households have maintained links with rural areas. Poorer households who keep buffalo may find that, in times of hardship, they have to sell their livestock. This has long-term implications, as it is very expensive to buy buffaloes (around Rs15,000), and it would be difficult to get re-established as an urban dairy. Keeping livestock also provides a reliable source of fuel for households, as some of the dung is used as a cooking fuel. Using dung reduces the need to purchase fuelwood or LPG, providing an additional saving to household costs. This would also be lost if the buffaloes were sold, increasing household costs as well as potentially reducing access to milk.

It is unlikely that employment beyond owners of livestock, farmers and the casual farm labourers discussed above is significant. The sale of milk from the small urban dairies is generally undertaken by family members, though more commercial urban dairies and milk booths do create employment and some owners of larger numbers of pigs employ people to keep track of their roaming animals. Income from milk varies according to how many animals are lactating and the quality of the fodder. At Rs 10 per litre, a family owning buffalo as their main source of income may bring in around Rs 150-200 per day. Income is also derived from selling dung, sold at between Rs 300-400 per tractor load (which is around 4 tonnes). Each animal produces almost one tractor load of dung a year.

The marketing of horticultural produce is broadly the same for produce grown close to the city and further away. Though small farmers living close to the city have easy access to markets, farmers with access to a bus route into the city can still bring in produce relatively frequently. This is particularly important in Hubli-Dharwad because of the lack of cold-storage facilities. Produce has to be sold quickly and, therefore, frequently. Some farmers employ people (generally women) to sell fruit and vegetables on their behalf in the markets and alongside the main roads. This is on a casual, or informal, basis.

The sale of food waste by hotels is unofficial, as is the sale of waste from poultry farms and slaughterhouses. Livestock keepers and farmers make contracts to obtain wastes and, though there are no formal markets, it does appear that much of the urban waste is used productively. The generation and use of urban wastes does not appear to create much employment, but bribes are paid, for example, to hotel employees for them to save the waste.

7. Gender aspects of urban agriculture

According to census data, there are far more women involved in urban agriculture than men. However, it does appear that fewer and fewer women are depending on urban agricultural activities, which may be due to the availability of other income-generating activities, either formal or informal, which they can undertake within the context of other household duties. Agricultural activities do, though, remain a significant employment opportunity for the urban female workforce[4]. Male employment in casual farm labour decreased as more males took up urban-based casual employment, particularly construction work (University of Birmingham et al. 1998).

As far as livestock keeping is concerned, there does not appear to be any straightforward relation with gender roles in the urban areas. Many households in urban areas tend to rely on a number of income-generating activities and the care of livestock may fall to household members with time available to care for the animals. However, it does appear that male members of households (either husbands or sons) tend to be responsible for delivering milk to customers from urban dairies and are responsible for looking after pigs.

Responsibilities for tending sheep and goats within the urban and periurban areas do not appear to fall necessarily to either males or females. Again, there may be an element of responding to opportunities. Opportunities for informal and casual employment may be quite different for men and women, and these opportunities may be taken into account when deciding which to pursue and who takes responsibility for livestock.

The purchase of urban wastes, from municipal solid waste to dung, is a male responsibility, though there may be an element of decision-making within farming households over when to buy waste, how much and from where. It is also not clear how income arising from urban agricultural activities is distributed within households. The different gender roles may, in turn, influence access to income from such activities.

8. Existing policies regarding urban agriculture

As there is no official recognition of urban agriculture, there are no policies within Hubli-Dharwad that support or encourage this activity. There are, however, a number of responsibilities of the urban authorities that affect urban agriculture. These are land-use planning, environmental health, issuing permits to keep more than ten livestock, and the maintenance of urban infrastructure. Land-use planning is conducted by the Hubli-Dharwad Urban Development Authority, which draws up a Comprehensive Development Plan every 10 years or so. Within the plan, land is zoned into different uses. The Authority maintains a green belt around the city, where agricultural land remains but, even in these areas, developers can request changes to the Plan.

The urban authorities are charged with maintaining the infrastructure of the urban area, including keeping streets clean and delivering drinking water to urban dwellers. Although these activities may not always be as effective as desired, there is concern that the presence of livestock in the urban areas makes such responsibilities even harder to fulfil. The Environmental Health officers of the Hubli-Dharwad Municipal Corporation have been attempting to shift hundreds of pigs out of the city for about 10 years. The pig owners' association went to the High Court and obtained a "stay", but in 1997 the High Court revised its decision in favour of the Municipal Corporation. The municipality began catching 50-60 pigs per week in 1997. This has prompted some pig owners to sell their pigs before they are seized.

There is legislation regarding keeping livestock in urban areas. The Karnataka Municipal Corporations Act 1976 sets out that permission is required to keep more than ten animals within a corporation area. The annual fee is a minimum of Rs 200, which is paid by poultry and commercial dairy owners. There are very few permitted dairies or poultry farms in Hubli-Dharwad.

The Supreme Court of India produced an Interim Report in 1998, making recommendations for improving solid waste management in cities. One section of the report refers to the “cattle nuisance” in cities, and recommends imposing a ban on “stray” cattle and the phasing out of sheds within cities of a population greater than 500,000. Buffaloes are generally kept in stalls and are led out to grazing by their owners, and therefore do not roam freely. If, however, the phasing out of cattle sheds were to include sheds for buffaloes, this would obviously have an extremely detrimental effect on the livelihoods of small urban dairy owners. It would also increase the market opportunities for more commercial dairies on the edge of the city with greater access and resources to obtain fodder, and yet with relatively easy access to the urban market.

9. Constraints and opportunities

There are a number of problems associated with urban and periurban agricultural activities in Hubli-Dharwad, some of which have been noted in previous sections. Livestock contribute to traffic chaos, are at risk from ingesting “foreign objects” and there are sometimes problems accessing grazing land and adequate fodder. However, livestock also consume a lot of organic urban wastes, and cows and buffaloes provide fresh milk to the urban market.

Table 5: ***Advantages and disadvantages associated with keeping livestock in Hubli-Dharwad***

	Advantages	**Disadvantages**
Input supply / production	• availability of vegetable waste; • availability of sewage water.	• lack of water; • lack of fodder and grazing land.
Transformation and commercialisation	• dung as fuel and fertiliser; • access to markets.	• lack of storage.
Management	• consume organic waste and some night soil.	• traffic chaos; • blocking storm drains; • lack of space to keep livestock and store fodder and dung.

The generation of dung in the urban area reduces the demand for fuelwood (the most common source of fuel for cooking in low-income urban households in Hubli-Dharwad), as some dung cakes are sold as well as being used in the urban dairy households. The dung and poultry droppings are also sold to farmers close to the city, providing additional sources of organic fertiliser and contributing to the return of nutrients to the soil.

Urban-based wastes and the market presented by the urban area present opportunities for horticulture around the city. In the absence of sewage-based irrigation, there would undoubtedly be less horticulture around the city on account of the inadequate water supply, including the lack of maintenance and draining of lakes. Horticulture is also constrained by the lack of storage facilities in the city, though this may be an opportunity that is exploited by farmers able to raise numerous crops through using wastewater. They increase their prices in off-seasons, something which they might not be able to do if there were storage facilities.

The lack of recognition of the role of urban agricultural activities within Hubli-Dharwad poses a particular obstacle to the future support of this sector. There do not appear to be any plans to support the development of agricultural activities within the urban area, in part because urban authorities are not charged with supporting these activities. Such a role would have to be decided at a national or state level and additional resources given to local authorities. The lack of authority associated with urban agriculture is exacerbated by the lack of co-ordination between organisations with potential interests in this area. The institutions with interests in urban and periurban agriculture include the Municipal Corporation, the Urban Development Authority and the Departments of Agriculture, Horticulture and Animal Husbandry.

There are no non-governmental organisations (NGOs) involved in supporting urban agricultural activities within Hubli-Dharwad, perhaps reducing the ability of people involved in urban agricultural activities, such as pig owners, in effectively promoting their cause to relevant authorities. Support from NGOs might also help urban farmers to gain better access to credit and other inputs, including advice.

10. Perspectives for the development of urban agriculture

There are a number of current and expected initiatives that will further constrain the opportunities for keeping livestock in the city. This will force many households to change their livelihood strategies, which for some households will be quite challenging, as they have come from generations of livestock keepers, particularly the gowlies.

There is much research that could be done to contribute to supportive policies, both for cities of the size of Hubli-Dharwad and for the metropolitan cities. There is a long tradition of certain agricultural activities within urban areas in India, notably livestock keeping, though many urban dwellers have maintained links with rural areas, owning land that may be cropped by themselves or rented out to others.

The extent of urban and periurban agricultural activities has implications for many policy areas, including waste management, land-use planning and market support. It is crucial that these are adequately understood to inform policy-making in these areas. There is, additionally, a need to improve communication between livestock owners and urban authorities. If a dialogue could be established, some of the constraints to keeping livestock in cities, both current and expected, could be reduced. In turn, the problems associated with the livestock, real and perceived, could be reduced.

There is a need for greater guidance on the role of agriculture in urban areas from national government for municipal corporations and other urban authorities. In turn, more data on the extent of agricultural activities in urban areas would guide policy-making. Data is needed on the levels of production, the contribution to livelihoods and the problems arising from urban agriculture. The links between urban agriculture and household food security and livelihoods could be further researched, providing information for better-informed decision-making, both for households and urban authorities.

A number of issues could be addressed to improve the conditions of urban and periurban agriculture. These include the treatment of wastewater, exploring options for penning pigs and options for improving the use of municipal waste by near-urban farmers without making it prohibitively expensive. The availability of credit and extension advice for people involved in urban agriculture would help to support this important sector in Indian cities.

1 Recorded in Livestock Surveys undertaken in 1990 and 1997-98.

2 The 1990 figures were recorded as Hubli-Dharwad, whereas the figures for 1997/98 were for Hubli and Dharwad cities separately. The livestock census is carried out by survey and is a snapshot of the number of livestock in India.

3 The exchange rate is approximately Rs 40 to US$1.

4 This is consistent with a study conducted in 1997, which found that female occupation within casual farm work has increased relative to male employment within periurban areas.

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JAKARTA: URBAN AGRICULTURE AS AN ALTERNATIVE STRATEGY TO FACE THE ECONOMIC CRISIS

Ning Purnomohadi

1. Introduction

Metropolitan Jakarta houses almost 10 million people during the day and 8.5 million people during the night. Jakarta, on the northeast coast of the island of Java, is the capital of the Republic of Indonesia and the centre for national trade, industry and services, including agricultural development.

The climate in Jakarta is very humid and warm. The average annual temperature is 27^0C and humidity is between 80 and 90%. The annual rainfall is approximately 2000 mm, with highest rainfall in January and lowest in September. *Daerah Khusus Ibukota* (DKI) *Jakarta* (Special Capital City Region of Jakarta) covers about 650 km^2 and the average population density has reached 12,495 people/km^2. The population grows at 2.4% per year. The land is relatively low and flat and lies between 0 and 50 m above sea level. The soils are alluvial and fertile (Darmayanti 1994).

2. Urban agriculture in Jakarta

Most of the agricultural products consumed in Jakarta are imported from Bogo, Bekasi and Tangerang, the three satellite cities of Jakarta. However, what is produced in Jakarta itself is difficult to bring into the city on account of congestion and time constraints. Predictions are that, because of the economic crisis, urban dwellers will eat more vegetables since they can no longer afford to buy meat, fish or eggs (findings, own socio-economic field survey for this paper in 1999).

Table 1: ***Food production, demand and production as percentage of demand in Jakarta***

Crop	Production	Demand	Percentage (%)
Rice	13,467	1,083,405	1.2%
Vegetables	26,883	282,184	.5%
Fruit	44,443	226,852	19.6%

Source: Urban agriculture municipal office of Jakarta 1999

Urban farming spread quickly as a result of the crisis. For example, in 1998 hundreds of people swarmed without permission onto land near Pulo Mas horse-racing track to grow vegetables, and a cattle ranch owned by ex-president Suharto on the hills overlooking Jakarta was invaded by some 300 farmers. The flying police motorcycle patrols have failed to stop the land grabs and, in the end, the Governor of Jakarta gave the city's poor the permission to use idle land to grow food, urging them to obtain permission first instead of just grabbing it (AFP 1998).

2.1 Urban farmers

Urban farmers can be categorised into two large groups: landowners and (the majority) workers in urban agriculture. The latter group can work for a wage, rent the land (paid directly, in cash or in-kind, or by production sharing), using free accessible public land.

Table 2: ***Total population of Jakarta and number of farmers***

Region (district)	Total population	Urban farmers' status		Total no. farmers
	1997	Owners	Workers	1997
Central Jakarta	931,400	-	727	727
North Jakarta	1,659,100	1,955	16,475	18,430
West Jakarta	2,307,100	1,566	23,916	25,482
South Jakarta	2,087,200	2,124	2,632	4,756
East Jakarta	2,538,800	2,088	48,751	50,839
DKI Jakarta	9,523,600	7,733	92,501	100,234

Source: Statistical Bureau 1997

Most workers in urban agriculture are male farmers, mainly from West and Central Java. Only a few are originally from Jakarta (Betawi people). Very few of the workers own land in their home village.

Urban farming in Jakarta (Picture Ning Purnomohadi)

Urban farming along the riverbanks in Jakarta (Picture Ning Purnomohadi)

Intensive vegetable production on vacant land (Picture Ning Purnomohadi)

Often these workers lost their previous seasonal job in the fallout of the economic crisis and are left with few resources. They try to find a job as a farm worker in the city during planting or harvesting. A few try to obtain a permanent job in the city, or join their relatives who already have permanent jobs in Jakarta. The village migrants usually come alone; they do not bring their families. Regularly, at intervals varying from two weeks to once a year, they return to their home village.

Urban agriculture provides workers, landowners and other people involved, with a small but significant income. Though it is limited, the workers use their income from urban agriculture (about Rp 10,000 to 15,000[1] per day) to support families at home by sending money for daily expenses as well as expenses like school fees or traditional ceremonies[2].

Few women work in agriculture. Generally, men are engaged in urban agriculture throughout the season, in land preparation, watering, planting, weeding and harvesting, while women usually work only twice during the season in urban agriculture: during periods of planting and harvesting. As the work that women do is considered lighter, they are paid less. Women do tasks like selecting vegetables and making bunches of vegetables.

Contracted workers are usually paid according to the type of work they do. A typical example is:

Land clearing	Rp	15,000 for women worker per day
	Rp	20,000 for men workers per day
Transplanting seedlings	Rp	250,000/ha
Applying fertiliser	Rp	60,000/ha
Maintenance weeding	Rp	15,000/day
Harvesting	Rp	80,000/600 kg

Migrants live together in very small crowded houses in areas which expanded into slums all around the city. Some of the workers live on the farms, in very small huts. The municipality has not been able to provide housing for the migrants.

3. Use of urban areas

More than 11,000 ha of land are used for urban agriculture in Jakarta. The land can be classified into various types:

- *vacant land*: property of bankrupt or "collapsed" developers (e.g. Kelapa Gading Industrial Estate) and part of the municipal greenbelt areas (e.g. Pulomas and ex Kemayoran Airport area);
- *riversides and roadsides*: belonging to Public Works, which co-ordinates flood canals (e.g. Banjir Kanal near Hotel Indonesia, along Jalan Inspeksi Dukuh Atas and the roadsides at Mutiara Film Settlement);
- *homegardens;*
- *others*: many smaller areas used by the small-scale producers, such as the BPKP Office garden in Jalan Pramuka, next to Salemba's jail, etc.

Land tenure in Jakarta is not very secure, although generally urban agriculture is not repressed there. However, 90% of the land used for urban agriculture is owned by real-estate developers or by the central or local government. This means that the land, once the economy picks up again, might easily become a construction site again. At the moment, however, urban agriculture obviously plays a positive role in making urban wasteland productive and turning waste dumps into green areas.

Table 3: ***Agricultural land use in DKI Jakarta***

Region	**Paddy field (ha)**				**Total**	**Dryland (ha)**				**Total wetland & dryland**
	High-input	**Moderate-inputs**	**Low-input**	**Dry *sawa***		**Home garden**	**Vegetable plantations**	**Other**	**Total**	
Central	-	-	-	-	-	46	23	23	92	92
North	-	1150	125	5	1280	1193	185	551	1929	3209
West	80	140	20	100	340	1302	166	275	1743	2083
South	-	-	-	14	14	1635	486	80	2201	2215
East	660	-	230	225	1115	1331	1162	20	2513	3628
DKI Jakarta	740	1290	375	344	2.749	5507	2022	949	8477	11,226

Source: Statistical Bureau 1998

People engage in urban farming to survive. Often the farmers are in debt to the middlemen who sell their produce; this gives the workers very little scope to bargain for better prices. The production systems are usually very intensive and often chemical fertiliser and pesticides are applied. Farmers take water from polluted rivers and at times apply fertilisers improperly and use banned pesticides.

Farmers grow a variety of crops, dependent on the soil conditions. Most crops have a short growth cycle (about 30 days). Favourite leafy vegetables are morning glory (*Ipomoea aquatica* - locally known as *kangkung)*, spinach, lettuce, green mustard, basil and cassava. In the past three years, yields significantly improved, especially in the case of spinach and morning glory.
Ornamental plants are also grown, particularly in the Mutiara Film Complex, as well as in many other strategic locations, such as along roadsides.

Table 4: ***Utilisation of vacant lands in August 1999 in Jakarta***

	Area (ha)	**Land in use (ha)**	**Cultivated crops**	**Produce (tons)**	**Labour (person)**
Central Jakarta	60	29	Chilly pepper, spinach, morning glory, lettuce, *caisim*, tomatoes, maize, cassava, sweet potatoes	4	340
North Jakarta	1168	671	Vegetables, chilly pepper, morning glory, chinese cabbage, paddy, spinach, tomatoes, melon, lettuce	11	2600
West Jakarta	748	445	Spinach, morning glory, groundnuts, maize, lettuce, stringbean, *Luffa acutangula*, chinese cabbage, *caisim*, eggplant	3203	3781
South Jakarta	417	110	Maize, cassava, eggplant, lettuce, chinese cabbage, morning glory, groundnuts, jasmine, *Ixora rosea,* chillies, stringbean, cucumber	395	343
East Jakarta	326	277	Vegetables, groundnuts, cassava, spinach	2148	1420

Source: field survey Ning Purnomohadi

Crops are marketed mainly by middlemen, who come directly to the farm to buy the produce. Often farmers can sell only to one or two middlemen, because they are tied to them due to debts incurred, resulting in very low prices for the farmers. Some produce is sold directly to nearby markets, or sold directly by the producers by street vending in the neighbourhoods. Some restaurants also buy directly from farmers. Usually, this is cheaper for restaurants and the produce is fresher than if they would buy from stalls or supermarkets. A good example of this is in the Kelapa Gading area, where many Chinese restaurants are located.

4. Selected examples of ongoing urban agriculture

4.1 Pulo Mas residential area

Pulo Mas in East Jakarta consists of middle- to high-class residential areas. Located behind a well-known business area are squatter settlements in Pulo Asem and in the Velodrome area. Here, a greenbelt of 25 ha is located. The area is property of the Municipality of Jakarta. Recently, the area was reduced in size, but it still functions as a water-retention area for the eastern part of Jakarta. The same piece of land is also used for other activities, such as football, a horse-racing stadium, some urban forest and agriculture. On the western side of the stadium, luxurious apartments are built.

Of these 25 ha, an area of 2 ha is used for agriculture. The land is controlled by two “big bosses” who hire about 30 farm workers. In return, they keep the stadium clean. Each worker receives about Rp 10,000/day, not including harvesting fees. The boss takes care of the marketing, the produce being mostly sold directly to consumers. Most workers come from West Java. Some come from Central Java, which is further away, but still close enough for daily commuting.

The land is used for intensive vegetable production. Vegetables like spinach, lettuce, green leafy *sawi* (*Brassica rugosa*) or Chinese cabbage, morning glory and cabbage are sown and all crops are harvested in 25-30 days. Production takes place on small raised beds or *garit* of 10 m x 60 cm in size. The beds are designed so that they are easy to maintain and can be watered with a water container in one movement, back and forth. “Small” containers called *gembor* are placed in each hand, each being able to water two garits at a time. The plots near the Sunter River are irrigated three times per day with water taken directly from the river. The plots further away are watered from a retention basin or pumped from wells. The retention basins are placed in the middle of the land in between the garits.

Ten days before seedlings are planted, organic fertilisers and water is applied and mixed with the soil. During the growing period, chemical fertilisers (urea and TSP) are applied. Pesticides are used to protect the plants.

4.2 PT Gading Kirana Company site

PT Gading Kirana is a real-estate developer but, because of the Asian financial meltdown, the land lies wasted. The company then decided to lease the 2000 m^2 to farmers for Rp 20,000/month/plot. The money is collected by the company's security staff. The farmers have a contract allowing them to carry out agricultural activities and obliging them to maintain the fence.

4.3 Indonesian Navy industrial area Kodamar

A 25 ha compound in Kodamar, owned by the Indonesian Navy, is used as a paddy field. The Navy Co-operative Office (Inkopal and Primkopal) hires farmers to work the land and the farmers receive monthly wages. The farmers, who originally come from Inderamayu, Karawang, Cirebon and Central Java, were already paddy farmers, and now work here on a seasonal basis. There are, however, plans to develop this "vacant" land in the near future, to construct houses for navy personnel. About 100 farmers are hired for planting, fewer people during the growing season, and 20 workers to harvest the crop. A high-yielding variety of paddy (IR 64) is grown twice a year, and the total annual harvest is between 150 and 300 tons.

4.4 Urban agriculture along roadsides

About two ha of vacant land on green "islands" between three streets have been planted with vegetables, along Jalan Pramuka, Jalan Pemuda, and Jalan Ahmad Yani. Three years ago, a local youth association, *Forum Komunikasi Putra Putri ABRI – Indonesia* (FKPPI) decided to start practising agriculture. About 25 farm workers now work under "one boss". They live in small, very simple, cottages around the land and receive Rp 10,000/day plus a bonus during harvesting, dependent on their harvesting skills. The produce is sold directly to consumers. In the past, these areas were just used as a waste dump, but now the area has taken on an attractive green appearance, not to be missed when driving on the freeway that crosses above the area.

4.5 Urban agriculture along canals and riversides

Urban agriculture is also found on the riverbanks in front of the Shangri-La Hotel, the BNI buildings and also behind Hotel Indonesia. In between the fields are many stalls selling foods and other daily necessities. Usually, the farmers cultivate only two or three kinds of plants, like leek, morning glory and green *sawi*. There is great potential to further develop urban agriculture on riverbanks such as along the flood canal "kali" Malang (a branch of the river Ciliwung), which is presently home to illegal semi-permanent houses and, in some places, street prostitution.

4.6 Kelurahan Sukapura

Kelurahan Sukapura lies close ton the coast. In this area, there are two large farming enterprises which grow only one crop: morning glory. The reason for this is that the land is swampy, permitting few options besides morning glory. The sites are in the middle of an industrial area next to many industries, but also near large and very densely populated squatter settlements.

One site of 10 ha is rented by a Madurese, who hires 30 skilled workers from Indramayu. The farm is organised as an efficient production system. Water is drawn from the Cakung drain. To protect the crop, pesticides and herbicides are applied. The morning glory production is marketed throughout DKI Jakarta. Usually, middlemen are very willing to come directly to the farm.

The other site of 15 ha is located behind container warehouses, along the Cakung drain. The land is owned by a developer, who rents his land out for Rp 20,000/ha/month to individual farmers, mostly people from Jakarta. For marketing, these farmers very much depend on middlemen, because only they are willing to come directly to the farm. Prices are thus determined by the middlemen. The farmers receive Rp 600 per bunch of morning glory while, in other places, the prices can be five times higher (up to Rp 3,000/bunch). The water used is drawn from the Sunter River.

5. Policy perspective on urban agriculture

The widespread nature of urban agriculture in the last two years, which has developed in response to the economic crisis, is seen as a temporary phenomenon. Urban agriculture has still not been included in the urban Master Plan of the city. Neither is urban agriculture included in the existing policy on Urban Green Open Spaces (UGOS).

On account of the latest economic crisis, more and more vacant land (or *Lahan Tidur)* is being used for farming. The municipality, realising the need for cheap and healthy food for the urban poor, issued the Governors' Decree No. 184, entitled "Private Owned Vacant Land Used for Urban Agriculture Practices in DKI Jakarta Area" on March 9th, 1998. This stipulates that the landowners and the urban farmers should sign a formal contract to avoid illegal practices. The local government provided a list of landowners who, for the time being, are not able to develop their land according to their plans. In these cases, the landowners willingly lend out their vacant land to farming purposes.

There are a number of laws potentially affecting urban agriculture, but none of the laws specifically refer to it. One example is Law No. 7/1996, which states that sufficient food, both in quality and quantity, should be available for all households at all times. The law envisions a role for municipal government and the urban community in providing food. The municipal government should enhance food security through a “sound” food management system, through training, control and so on.

Another example is the "greening programme", which started in the early 1990s. Jakarta planned to have at least 25-30% of the UGOS improved, in order to obtain a “balanced environment”. However, the development of UGOS was given last priority, and has practically resulted in neglect. For the time being, the greening of Jakarta has not even improved by 10%. The One Million Trees Campaign launched in 1993 has slowed down. Because of the economic crisis, the budget for city park maintenance and rehabilitation has been drastically cut. When the central government initiated the ADIPURA[3] award programme, the development of urban agriculture was not encouraged as part of the urban green open space system. It was argued that urban agricultural produce is contaminated because of air pollution.

It seems, therefore, that Jakarta Municipality sees a role for urban agriculture in the short term in order to overcome the impacts of the Asian economic crisis, but does not regard it as a tool to contribute structurally to urban development.

6. Opportunities for urban agriculture

The Asian crisis created opportunities for urban agriculture, as the people in cities are in need of new solutions for overcoming their problems. From the activities of the people of Jakarta, it appears that urban agriculture offers some solutions.

The increasing (economic) importance of urban agriculture should facilitate its inclusion in city planning and the specification of agricultural areas in urban zoning. Urban agriculture should be treated as an integral part of the urban ecosystem. With sufficient appropriate space, it will be easier for urban dwellers to generate alternative income through farming or home gardening.

The role of the local government in expanding urban agriculture could be great, through focusing on production, marketing and consumer aspects, as described below:

- *production aspects:* the provision of basic technical information and scientific data for urban agricultural development for all stakeholders could range from a set of reliable updated city maps to practical guidelines, standard operating procedures for urban agriculture, training, demonstration plots, etc. This is especially important to avoid pollution through urban farming. Vacant lots could be used much more, in addition to intensive techniques for small spaces, such as container-based farming and hydroponics (Wade 1986);
- *marketing aspects:* the government needs to reorganise distribution systems, and provide facilities for markets and marketing information. The local government could also facilitate co-operative marketing systems to avoid exploitation of farmers by middlemen;
- *consumer aspects:* the government has a responsibility to avoid contamination of food. A land suitability classification system could be made tin order o avoid contamination of crops by soil, water and air pollution. Another consideration is the promotion of food diversity.

Possible constraints for the implementation of urban agricultural programs are:

- better economic options from farmers in other jobs;
- continued land title insecurity, which could keep farmers from investing or continuing because of insecure prospects; and
- limited knowledge, including knowledge on marketing systems.

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1 *Rupiah (Rp)* 7500 = 1 US$

2 This income can be compared to other salaries: non-skilled construction workers earn around Rp 8,000 – 10,000/day, skilled workers between Rp 20,000 – 30,000/day, maids and servants earn cash between Rp 150,000 – 200,000 / month, but usually also have board & lodging and small medical expenses included. Lower class government salaries run between Rp 750,000 – 500,000 / month.

3 The ADIPURA award programme is co-ordinated by the State Ministry of Environment to award the greenest and cleanest city of Indonesia.

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LA PAZ: URBAN AGRICULTURE IN HARSH ECOLOGICAL CONDITIONS

Petra Kreinecker

1. Introduction

The republic of Bolivia is one of two landlocked countries on the American continent. The Andes in the west of the country covers 40% of the country. The Bolivian Andes can be divided into two mountain ranges: the Western (*Cordillera Occidental*) and the Eastern Range (*Cordillera Oriental*). These include the highlands of Altiplano at 3,000-4,500 m above sea level (a.s.l.).

Administratively, the country is divided into nine departments and subdivided into 98 provinces. La Paz is the capital of the Department of Murillo, the seat of the Bolivian Government and effectively the capital of the country. Constitutionally, however, Sucre is Bolivia's capital (Munzinger Archiv 1993). La Paz is situated at 3,600-3,800 m a.s.l., while the gigantic suburb El Alto, meaning the high city, is located at 4,000-4,100 m. La Paz lies in a basin with suburbs spreading into the surrounding hills and mountains.

Since the land reform of 1952, an enormous migration from the Altiplano to La Paz started, which even increased after the drought of 1984. As a result, El Alto expanded rapidly. The huge suburb has had an autonomous administration since 1989, but El Alto and La Paz are still strongly interdependent. In this case study, La Paz and El Alto are treated as one heterogeneous unit, taking into account their parallel urbanisation (MOPU 1990). The character of the Andean metropolis is determined by a multitude of ethnic cultures, their languages and social differences[1].

The climate of La Paz is strongly influenced by the extreme altitude of the city. Temperature fluctuations between day and night can be as much as 20°C. The average annual temperature does not exceed 10°C, with the exception of the lower southern part of downtown La Paz (Statistisches Bundesamt 1991).

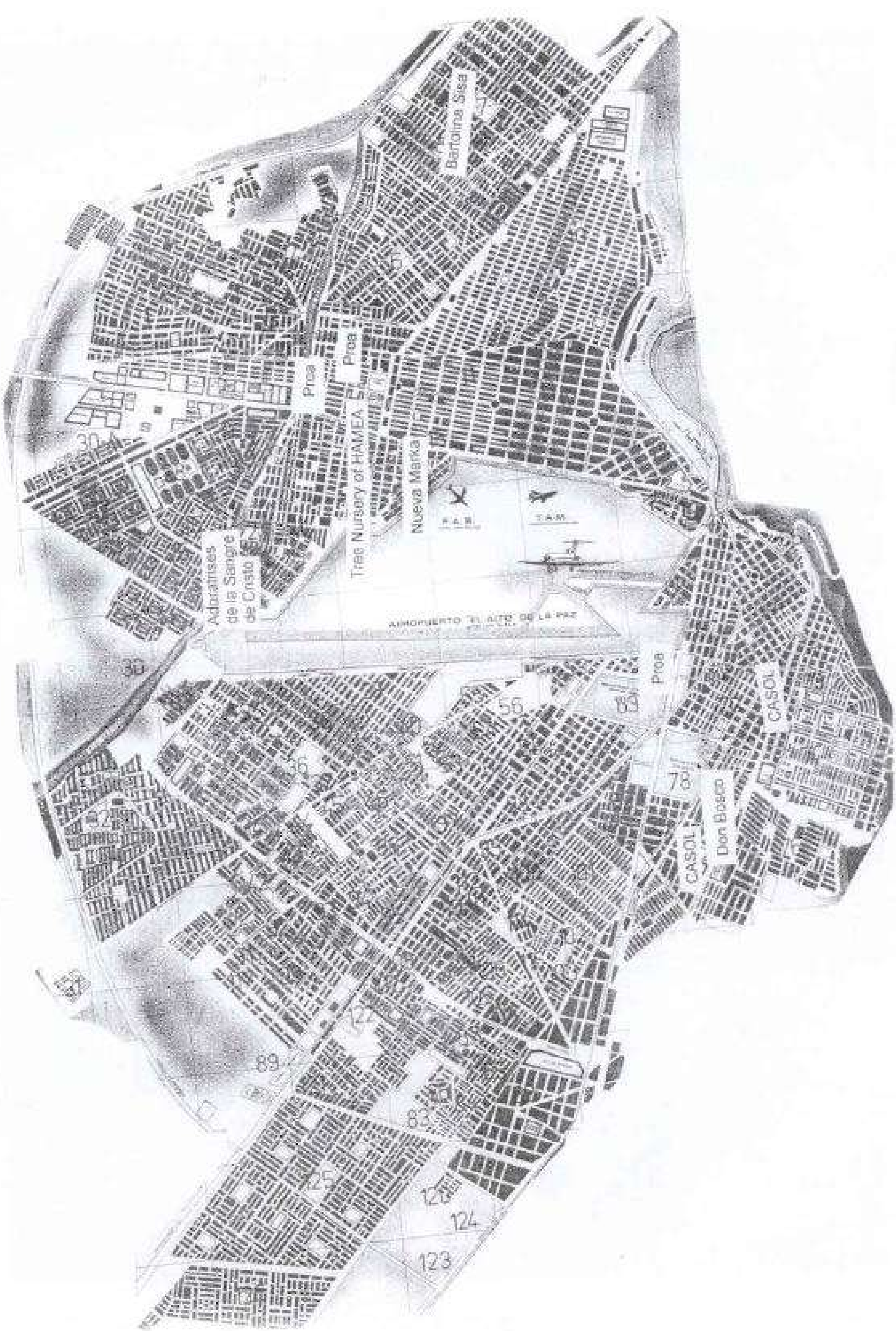
La Paz has a semiarid climate with a long dry season. The intense sun at this high altitude dries the earth and turns it into a crusty and salty surface. The Bolivian summer has a short rainy season (December-March) with annual precipitation between 550 and 800 mm (Arze & Weeda 1996). El Alto is cold (17 to -4°C) and windy. The average wind speed is 67 km/h. The temperature differences between El Alto and the lower parts of the city can be as much as 10°C during the day (Sandoval & Sostres 1989). La Paz/El Alto is thus one of the urban metropoles in the world with the largest climatic differences within one city (Schoop 1981).

In 1997, La Paz had between 1.3 (1992 census) and 1.5 million inhabitants (INE 1997), with an average annual growth rate of 1.78% (Ministerio de Planamiento y Coordinación 1992). The growth rate of El Alto stands much higher at 9.23 % (INE 1997), with an immigration rate of more than 40% (Prudencio Böhrt 1995). The population of El Alto is expected to grow to 1,049,176 inhabitants by the year 2000 (UN 1991). The population density of La Paz in 1992 was 246 inhabitants/km^2 (INE 1997), whereas El Alto recorded in1988 only 59 inhabitants/km^2 (UN 1991).

The more difficult it became to find a place in La Paz, the more the settlements expanded to El Alto. Parallel to the migration from the Altiplano to La Paz, the children of the first generation of migrants left the city centre of La Paz for El Alto in search of cheaper places to live (Valdés 1997, Ströbele-Gregor 1990).

El Alto is marked by openly visible misery. In 1997, 72.9% of households were living below the poverty line (Ministerio de Planamiento y Coordinación 1992). For Ströbele-Gregor (1994), El Alto is a "symbol for the ugly sides of the so-called Third World's capitalism and modernisation, but also for creativity and vitality". The official unemployment rate in La Paz is 5%, in El Alto 4% (INE 1997). La Paz is also referred to as "the city of contrast" (Bruns 1994).

Sixty-five percent of El Alto's inhabitants maintain a close relation with their village of origin, and 10% are somehow connected to rural agriculture. Organising their lives in an urban context, the migrants rely on a mixed economy and a complex social network. They are linked to their *compadres,* based on Andean reciprocity. Within the network, labour, goods and mutual support are exchanged, a generations-old custom. Temporary migrants may also count on the help of their *compadres*. In exchange, the latter receive products from the Altiplano and go back to the village to help with the harvest or to collect their share (Kreinecker 1996, Sandoval 1994, Sandoval & Sostres 1989).


Bartolina Sisa
Proa
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Tree Nursery of HAMEA
Nueva Marka
Adoratrises de la Sangre de Cristo
AEROPUERTO "EL ALTO" DE LA PAZ
Proa
CASOL
78
CASOL
Don Bosco
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123

Carpas solares from CASOL (Picture Petra Kreinecker).

Maize production at Avenida Kantutani, La Paz (Picture Petra Kreinecker).

"It should not be overlooked that this type of economy, based on social networks and characterised by a combination of different activities, social forms of work organisation and the exchange of labour and goods, has its origin in Andean rural economy, socio-political forms of organisation of the village community and – not the least - in a religious conception of the world and the pertaining system of norms and values" (Ströbele-Gregor 1990).

2. Ongoing urban agriculture

According to the INE (1997), 3,970 persons in La Paz and 1,975 in El Alto formally worked in the agricultural sector in November 1997. In June 1996, this figure was still 4,482 for La Paz and 3,474 for El Alto. In the informal sector (70% of the national economy, Alvarez 1999), 4,148 persons in El Alto and 3,474 in La Paz worked in agricultural production (INE 1997). Of La Paz's total area, 2,950 ha are used for agriculture (see Table 1). It is estimated that almost 30% of La Paz's agricultural requirements is produced in urban agriculture (HAM 1992).

Table 1: ***Urban agricultural area and consumption of easily perishable crops***

City area of La Paz	Agricultural area (ha)	% of consumption of easily perishable crops	Estimated consumption in La Paz (tons/year)
West	1,250	14.60	3,307
North	100	0.04	265
East	400	0.15	794
South	1,200	13.50	3,175
Total:	2,950		7,540

Source: HAM 1992 and own calculations

Urban agriculture exists in every corner, near the centre as well as on the outskirts of the city. Every inhabitant of the poor quarters knows what is behind the high clay walls. Hen-cackling and the grunting of pigs is everywhere. However, if you would ask officials about urban agriculture, they will shake their heads, or some will smile with pity. The secretary-general of El Alto's municipal government confirmed that "something like that" does not exist in El Alto, while he passed by sheep grazing at the roadside. A representative of a church organisation assured that one does not find agriculture in the city. Nevertheless, opposite his office is a greenhouse in a courtyard.

"Urban Agriculture" is a technical term used by the few experts or NGO representatives who support urban agriculture in projects. The city farmers themselves neither use this term, nor do they understand it as a concept.

2.1 Coping with difficult conditions

Urban agriculture in La Paz and El Alto means primarily growing vegetables. While co-operatives also grow for the market, one will find that mainly traditional vegetables are grown in backyards. In addition, small animals are kept, mainly for subsistence reasons.

The destructive forces of the local climate determine agricultural production. The growing seasons are short, and plants need protection from the cold and wind. Irrigation in spring, autumn and winter is essential. Water supply is one of the biggest difficulties faced by city farmers.

Whereas the co-operative CASOL[2] and the producers' association in Achocalla have to pay for expensive potable water from the public water supply, the Municipal Office (*Alcaldía),* waters its trees with well water[3]. The women's association Bartolina Sisa obtains its water with a diesel pump from a 60 m deep well all year round (Jahn 1999). The farmers in the south of the city use water from the highly contaminated Río Choqueyapu (HAM 1992). Private households use water from the public water supply, if they are connected, and rainwater in the wet season[4]. Only one sprinkler system was found, in Santa Cecilia, a home for blind women.

The heavy clay soils of the city are not very fertile (Jahn 1999). Different practices are commonly used to preserve the soil fertility and without which no agricultural use would be possible. Besides animal manure, also kitchen waste, ashes, sand, lime and similar everyday products are also used as fertilisers (Jahn 1999). The cold and dry conditions limit the natural production of compost and make it a lengthy process. Often, unfinished compost is used. In El Alto, compost heaps can be found in greenhouses or in dugout holes to accelerate composting.

2.2 Urban farming systems

Agricultural production takes place on open fields and in private home gardens. Native crops like potatoes, beans and maize, which are adapted to the local conditions, are

grown. Sometimes, one might find wooden fences (*semi-sombra*) sheltering potato and bean crops from wind and sun.
Occasionally, one can find a small quinoa field. Pharmaceutical plants and spices are also integrated into the system. More rarely, vegetables or fruit are grown. These plants are not part of the traditional diet[5], and *"no se sabe comer"* (one doesn't know how to eat them).

In the communal gardens (*huertos comunitarios)*, however, plants are protected from the harsh climate. Greenhouses and beds covered with plastic hoods *(carpas solares)* predominate. The sizes of greenhouses differ according to the size of the plot[6]. The roof construction is either double glass, which allows more sunlight to penetrate, or the much cheaper polyethylene (Bourliaud et al. 1997). Both methods protect against the torrential rains, hail, cold and night frosts, and provide the microclimate necessary for a diversified production and prolonged growing season (Bourliaud et al. 1997, Prudencio Böhrt 1996). The construction of plastic hoods is simpler and cheaper, but also more transitory; they enable production in plant furrows mainly used to grow salad and vegetables. In the CASOL co-operative, a plastic hood (0.9 x 3.5 m) covers five furrows, in which 8-12 different crops are grown.

To protect crops in the first growing stages, covered nursery beds are used (*camas protegidas).* Jahn (1999) mentions a cover of *Ichu*-grass, a straw-like material. The specific microclimate and extra protection of these seedbeds is the basis for the huge variety of crops found in these gardens (Bourliaud et al. 1997).

Different things are tried to create more favourable growing conditions. The CASOL co-operative in Villa Tejada tried to use the greenhouse microclimate to grow mushrooms. Very big ventilation slots were built into the wall, which were supposed to improve the exchange of warm and cold air. This did not function properly, and consequently was not adopted by the women involved in the co-operative.

A large variety of animals are kept: chickens, ducks, guinea pigs, rabbits, pigs, even sheep and here and there the odd cow or two. Usually, poultry runs free in the inner courtyards. Guinea pigs and rabbits are kept in wooden crates or small fenced areas. Pigs, cows and sheep scavenge in public areas, roadsides, green strips or on vacant lots.

The domestic gardens are very small, on average 8-30 m^2. Officially, they are not regarded as agricultural production areas. The production of these gardens at first appears rather chaotic; nevertheless, there seems to be a plan and certainly a lot of knowledge behind their set-up. The trees in private gardens are first of all planted for aesthetic reasons, for shade or for their fruit (Arze & Weeda 1996).

Urban agriculture in La Paz and El Alto is characterised by low inputs of capital, fossil energy and chemical pesticides and by high labour intensity. Production is often organic. None of the projects and households studied used chemical pesticides or fertilisers.

Land titles are often unclear. Cultivating vacant plots is allowed, as long as the land is not needed for other purposes. Livestock is only tolerated. For example, the land titles of the CASOL co-operative seemed clear, after the NGO *Ricerca e Cooperazione* obtained land titles during the first phase of the project. At present, however, there is a legal battle[7] running with the heirs of the former landowners. The worthless waste dump, which was sold, had regained its value through cultivation, and now the owners try to reclaim the land.

Trees for reforestation and flowers for planting in the plazas[8] are grown by the government in tree nurseries at different sites in El Alto and Achocalla. Under the supervision of an agricultural engineer, tree seedlings are sown, raised and planted by the employees, mostly women. The women who work here make use of the greenhouses for growing salad and strawberries on their own account.

3. Urban farmers and their organisation

The majority of city farmers in La Paz and El Alto are marginalised women (Mejia 1996b, Prudencio Böhrt 1996, SEMTA 1995). The majority of the female city-farmers are migrants, primarily ethnic Aymara; their agricultural knowledge is based on a long tradition of farming. Farming is thus also a way to keep their heritage alive. Many are illiterate, most of them without means, many of them are housekeepers and thus the breadwinners of their families (Prudencio Böhrt 1996). In the case of CASOL, 60% of the members are migrant women from the Altiplano, 25% coming from the mining regions after the closing down of the state mines, the remaining 15% are women who moved from La Paz (Valdés 1997).

Often the producers are organised in co-operatives, associations etc. CASOL, with its 58 female equal partners, is an interesting example. Every six months, responsibilities are rotated in the organisation. An elected board runs the organisation, supported by the APC (Administración, Producción y Comerzialisación). The two executives of the board are elected for a period of two years[9] (Prudencio Böhrt 1996, Prudencio Böhrt 1995).

Also in the home for the blind, Santa Cecilia, urban agriculture means more than just the production of food. Blind *campesinas* from the rural areas of the surrounding departments come here to stay for some months. Here, they learn to deal with their handicap. With the aid of agricultural students from the Catholic University, they are taught how to perform agricultural tasks independently.

There are very few small businesses or enterprises that have developed from urban agriculture. A successful exception[10] is *Ventilla*, a small vegetable production enterprise in El Alto. According to Mejia (1996b) the supermarket chain *ZATT* has concrete plans to build greenhouses in co-operation with *Ventilla* near the city centre, to provide hygienically grown vegetables for their stores, which is often requested by customers who are used to the North American standard of other stores.

The women farmers of Achocalla founded an association to allow them to reduce the high costs of marketing their produce (SEMTA 1998). For the long term, they are seeking a joint venture with the *ZATT* and *KETAL* supermarkets. They do not expect too much from these negotiations, until they have received official ecological certification of their produce[11].

4. Role of urban agriculture for urban food security, nutrition and health

Families in La Paz spend between 52% and 83% of their income on food (Prudencio Böhrt 1995).

The partners of CASOL produce only 1.7% their energy intake. Thus, despite the rather large area of arable land for staple foods, urban agriculture contributes little to the food energy supply.

Urban subsistence production increases the diversity of foods, as all women interviewed[12] pointed out. A comparison of the CASOL women's food basket to that of non-farming women showed that the consumption of vegetables in socio-economically comparable households without self-production is less varied and mostly confined to carrots and onions (Prudencio Böhrt 1995).
Poultry kept in the yards guarantee the supply of protein and energy at a price that even families with few resources can afford (Wieman & Leal 1998).

According to some sources, the contribution of urban agriculture to food security could be higher, but the loss of indigenous knowledge or the incapability to adapt this knowledge to the urban environment leads to poor storage and processing techniques, which increase post-harvest losses[13].

The availability of water is insufficient, and untreated or contaminated water is often used. This leads to the spread of infectious diseases (Acebey 1996). The inappropriate disposal of waste leads to additional sources of infection. At least 20% of organic waste is dumped in the rivers or valley gorges. Soils and wells are often contaminated with lead and sulphuric acid. Rubbish piles up at empty sites, on the plaza or at the roadside. Food sold in the markets or by the roadside shows a high degree of chemical contamination (Mejia 1996a). However, reliable data identifying the source of contamination are not available.

In the first half of 1998, the City Government of La Paz started a "pig campaign". All domestic pigs in city territory were captured and killed. There was reason to suggest that part of the domestic pigs were infested with trichina (*Trichinella spiralis*), which led to the complete extinction of pigs in the city[14].

5. Urban agriculture and the urban environment

Apart from the non-existent political responsibility, the climatic and geographic peculiarity of the city and the urbanisation rapidly deteriorates the city's ecological situation (Cardona et al. 1992). A lack of basic sanitation and the carefree exploitation of the few available resources, especially in semi-urban areas, are just two factors responsible for the further degradation of the environment (Acebey 1996). In La Paz, poverty is frequently identified as a factor in environmental destruction. The conclusion "the poor pollute the environment" is neither correct nor useful to understand the social dimension of ecology. Poverty and environment do not have an inverse relation; they rather can be regarded as parallel effects of the same unsuccessful globalisation process (MOPU 1990).

The still existing original vegetation in El Alto looks like "degraded relics" (Cardona et al. 1992). At the beginning of urbanisation, meadows were still protected as arable land and trees for firewood. The massive migration effectively did away with this.

One of the biggest problems is the contamination of rivers, 180 (!) surface and underground rivers and creeks run cross the city (Acebey 1996). UN studies found extremely high concentrations of heavy metals in the Río Seco. Mercury has also been found in water. The Orkojahuira River, which runs in the east of the city, drains untreated wastewater from the city hospitals. Contamination by chemical fertilisers or pesticides from urban agriculture can be excluded, as the farmers do not apply chemicals.

The Institute for Ecology of La Paz (Instituto de Ecología) conducted an inventory of trees in the city. In La Paz, trees fulfil important ecological functions in the urban metabolism (Arze & Weeda 1996). They clean the air, retain moisture and increase the humidity of the surrounding air. Trees markedly influence the climate in La Paz. They especially raise the humidity, and they control wind movements, guiding and channelling them. The network structure of the roots strengthens the soil structure and thus prevents soil erosion. The canopy and the leaves on the earth temper splashing rains and prevent the drying-up of the soil caused by the strong UV radiation at this altitude. The leaves preserve the soil’s humidity and organic matter from wind and water erosion.

6. Contribution to the household economy

“The concept of migration does not include agriculture, as the migrants have broken with their origins and thus with their rural identity”, says Caritas’ representative in La Paz. “It simply is not worth its while...” resumes a representative of the Institute for Ecology, “when a family of four has only 40-50 bs/month[15] to spend on vegetables, it simply does not reward all the effort to grow food in the city” - at least for a middle-class family. Nevertheless, families in poor quarters do grow food, even when many experts have their doubts on the economic profitability from a western point of view.

Beyond a monetary income of often only a few dollars per month, especially subsistence production in communal or individual private gardens makes a considerable contribution in kind to the household economy. Subsistence production reduces household expenditure for foodstuffs, which on average amount to 52-83% of the income in La Paz (Prudencio Böhrt 1995). Table 2 gives an example of the income share obtained from urban agriculture. The woman, a CASOL employee, who in addition cultivates her private garden, contributes 67% of the total household income. Her share is almost exclusively obtained from urban agriculture.

Table 2: ***Household earnings per household member***

Family member	**Job**	**Earnings in %**
Husband	Mine-worker, chauffeur	5
Wife	Employee at CASOL, salesperson, weaver	67
Daughter	Teacher	28

Source: Prudencio Böhrt 1995

The other CASOL women work four hours per week (2 full days/month) in the communal gardens, for which they receive about US$ 4.30. Though the monetary share seems small, most important is the non-monetary income.

7. Gender aspects of urban agriculture

Women play a central role in urban agriculture in La Paz and the economy. Paid work influences women's lives in two ways. They have access to and frequently also control over money; it enhances their social and domestic status, and they gain the freedom and power for decision- making. On the other hand, it also increases their dependence on a money economy on which they have no influence.

Experience shows that women constitute a valuable resource for the city and have to be regarded as the most active and effective social group (Mejia 1996a). "It is not a new phenomenon that women function as catalysts for their families in periods of economic crises. The women are the guarantors of the families' subsistence production, developing the most different activities", explains Valdés (1997) referring to the situation in El Alto.

Traditionally, however, the role of women is confined to the domestic, non-public area of doing unpaid house and reproductive work (Prudencio Böhrt 1996). This could be a reason for fewer women engaging in communal fields and greenhouses. Women working in home gardens situated in the immediate vicinity of the house are culturally accepted.

The women's decision to work at the CASOL co-operative was, in most cases, taken against the will of their husbands (and their children). The families were concerned that the work in the communal gardens would leave the women less time for their children, their husband and household tasks, while the money earned seemed too little. Another reason men gave for opposing their wives' joining the co-operative was that the women had to lower themselves to sell vegetables (Prudencio Böhrt 1995). However, the experience since 1992 shows that the common production has had positive effects on the socialisation and empowerment of women. For about 90% of the women, this is a reason for their continued work in the co-operative (Valdés 1997). The women have changed through the compulsory active participation in the co-operative's functions. They have learned to overcome their reserve and they have lost their fear to speak out in the group. Apart from the work-related knowledge, they are better informed on politics and the current political and socio-economic situation.

A growing independence of women in the urban context and the related change in traditional roles are cited by a woman in Cota Cota as probable reasons why her husband left her after she had begun to get more involved in subsistence agricultural production[16].

8. Existing policies regarding urban agriculture

In the last years, the increased national and international pressure on the Bolivian Government has led to more attention to environmental protection. In 1992, the environment action plan was prepared which, together with the establishment of the environment fund, laid the basis for political action. In 1993, the government of "*Goni*" Gonzales Sanchez de Lozada passed the *Ley de Participación*[17]*, a* reform programme for people's participation; a unique law for Latin America which, for the first time in Bolivia's history, took account of its multiethnic and multilingual society. Within the reform process, the status of the environmental sector was enhanced: the Ministry for Sustainable Development was founded. The municipality of La Paz is beginning to define something like an environmental policy (Prudencio Böhrt 1996).

The new laws and institutions indicate that changes are in the air. PADUM (*Proyecto de Asesoramiento al Desarrollo Urbano de la Alcaldía de La Paz*), a project financed by the United Nations and the World Bank, is elaborating a first development plan for the city.

Formally, there is no urban agriculture in La Paz or El Alto. Therefore, no relevant guidelines or strategy papers have been developed.

9. Factors hampering the development of urban agriculture in La Paz

Organisations that do work on urban agriculture mention different factors that negatively influence the development of urban agriculture in La Paz and El Alto:

- the cultural heterogeneity of a group limits the communal production, as migrant women often have knowledge only about Andean plants or no agricultural knowledge at all (Valdés 1997). The majority of the women are illiterate which, according to Valdés (1997), is a further complicating factor for applying new cultivation methods or adapting new technologies;
- the ecological situation of the rivers and the high prices for drinking water, particularly in Achocalla (SEMTA 1995) and in Rio Abajo (HAM 1992), threaten not just the living conditions of the agriculturally-active city population but also planned urban agricultural initiatives;
- climatic conditions: the short growing season limits the possibilities of urban agriculture and leads to higher production costs;
- uncertain land tenure and a lack of arable land and grazing land;
- scarcely available water for irrigation;
- individual subsistence farmers producing in private gardens are, to a large extent, excluded from financial, technical and material assistance. They do not have enough capital to invest in techniques adapted to the urban environment. This is one reason why they would rather grow staples than salad and vegetables, although the latter have higher returns per square meter; and
- lack of legislation and unclear responsibilities are seen as an important reason for concern, as these keep urban agriculture outside the necessary legal framework and push the activities into illegality. A clear example is the above-mentioned pig eradication campaign.

10. Perspectives for developing urban agriculture in La Paz

Urban agriculture in La Paz can be positively assessed as a survival strategy of socially marginalised people, mostly women, who are trying to improve their families' situation. Mejia (1996a) hopes that the new environmental law (*Ley de Medio Ambiente)* will improve the political framework. In his opinion, this law has a pivotal role and he suggests that a systematic spreading may have spontaneous followers which will increase the pressure on the politically responsible.

In La Paz, four main actors in urban agriculture can be identified: municipalities, NGOs (national or international), local initiatives of urban producers, and their organisations. Accordingly, there are different levels for devising future strategies.

A future strategy on a political level has not only to clarify the land-title situation in favour of the city farmers; it must also protect existing agricultural areas from further destruction by urban sprawl. The perspectives for urban agriculture should not depend on the government's goodwill. Local government should support existing local initiatives to strengthen existing groups of farmers.
A future strategy must strengthen the further development of technologies and cultivation practices. Numerous interviews made it clear, however, that projects are doomed to failure if inappropriate technologies are forced upon producers. Technology development should be participatory and take local conditions into account.

In the words of the director of PROA[18]: "A future strategy will have to emphasise research on existing structures and on socially accepted Andean varieties, if one is to improve the situation of marginalised people whose nutrition is endangered."

1 Aymara, Quechua, Spanish and another European, American and Asian languages.
2 Cooperativa Agrícola de Comercialización Solidaridad. According to the president of CASOL (February 1999), irrigation costs about 800 bs/month (IS$ 143) and is one of the highest expenses of the cooperative.
3 According to the director of the nursery Villa Tunar (February 1999).
4 Own survey (January/February 1999).
5 According to M. Pacheco, Executive Director of PROA (17.02.99).
6 The size of the greenhouses varies between 10 m^2 (Santa Cecilia) and 163 m^2 (CASOL).
7 Information from the president of CASOL (February 1999).
8 Plazas are rectangular squares, usually with a small park area. On numerous excursions and transect walks during the rainy season, I never found a green or flowering plaza in El Alto. According to the representative of the Alcaldía, this is because the local population is not interested. "*Así es nuestra gente, no cuiden las cosas*" (our people are like that, they don´t take care).
9 The Italian NGO Ricerca e Cooperazione pays the salaries of 250 bs/month for both women.
10 According to Mr Pacheco, Executive Director of PROA (Centro de Servicios Integrados para el Desarrollo Urbano), February 1999.
11 Oral communication of R. Valverde, SEMTA (February 1999).
12 Personal interviews (February 1999).
13 Personal communication, Director of State Home for the Blind and a NGO representative (1999).
14 Personal communication of the Secretary of AGUILA, J. Prudencio Böhrt (February 1999).
15 About US$ 7-9. The diet of Bolivian middle-class families contains very few vegetables.
16 Personal interviews (February 1999).
17 Important functions of the state were decentralised to the 296 municipalities, and the municipal annual budget was significantly increased.
18 Personal communication, Director of PROA (February 1999).

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Appendix 1: *Urban agricultural activities in La Paz and El Alto*

Overview of communal garden initiatives

District	Organisation	Form of organisation	Producers	Technology	Production	Reason
Achocalla	Asociación de Productores de Achocalla	Co-operative	Women	Greenhouse, *Camas protegidas*, plastic hoods	Vegetables, potatoes, medicinal herbs, guinea pigs	Sale, subsistence
Villa Mercedario	Asociación de Mujeres Bartolina Sisa	Women's organisation	Women	Greenhouse, *Camas protegidas*, open field	Vegetables, potatoes, cereals flowers, sheep	Subsistence
Villa Tunari Santiago I. Achocalla	Tree Nursery of Municipality of Alto	Governmental	Women	Greenhouse, tree nursery	Trees	Reforestation, planting of public areas
El Alto	Casa Waki	?	Street children	?	Trees	Reforestation
Villa Tejada Santa Rosa	CASOL	Women's Co-operative	Women	Greenhouses, plastic hoods	Vegetables, trees, herbs, flowers, strawberries	Sale, subsistence
Villa Tajada	Don Bosco	Convent Garden of Salesian Brothers	Monks	Greenhouses, garden, rabbit hutch, chicken coop	Vegetables, chickens, rabbits, pines	Subsistence
Pasankeri	Tree Nursery "Club de Madre"		Women	Tree nursery	Trees	Reforestation
El Alto	Military	-	Soldiers	?	?	Supplies for the army
Villa Tunari	Nueva Marka	Kindergarden	Nuns	Greenhouse, rabbit hutch	Vegetables, rabbits	Supply for kitchen of kindergarden
Villa Bolivar A. Esperanza V. Tupac Katari	PROA [c]	NGO	Women	Greenhouse, plastic hoods	Vegetables, angora rabbits	Sale, subsistence

Centre (Avenida Armentia)	Santa Cecilia	State Home for the Blind	Blind women	Greenhouse	Vegetables	Subsistence, education
La Paz	Siembra	-	Young people	Tree nursery	Trees	Reforestation
La Paz	Colegio Pasankeri (a.o.)	Ministry of Education Schools	Teachers, young people	Tree nursery	Trees	Reforestation
Villa Collpani	Colegio Técnico Humanistico Agropecuario Luis Espinal	School	Young people	Greenhouse, plastic hoods, *Camas protegidas*, open fields	Vegetables	School kitchen, sale
Cota Cota	UMSA*	-	Wives of diplomats	Herbal garden	Medicinal herbs	Charity

? = no data available
* = Universidad Mayor de San Andrés
Source: Kreinecker 1999

Private gardens in La Paz en El Alto

District	**Producer**	**Technology**	**Production**	**Reason**
Cala Cota	Women	Small domestic gardens	Vegetables, potatoes, beans, maize, herbs, pigs	Subsistence
Pasankeri	Woman	Small home garden	Vegetables, potatoes, beans, maize, herbs, guinea pigs, rabbits	Subsistence
Centre (Avenida. Kantutani)	Women	Home garden	Vegetables, potatoes, herbs animals (2 cows, guinea pigs, duck)	Subsistence
Zona Rio Abajo (Mallasa)	Women, families	Greenhouse, open field	Vegetables, potatoes, beans, maize, pigs	Subsistence, sale
Callapa	Women, families	Small home garden	Vegetable, potatoes, beans, maize, herbs, pigs	Subsistence
Rio Seco/Zona 23 de Marzo	Nuns of Adoratrises de la Sangre de Cristo*	Greenhouse, open field, chicken coop	Potatoes, onions, herbs, chicken	Subsistence

* Jahn 1999
Source: Kreinecker 1999

NGO EXPERIENCES IN LIMA TARGETING URBAN POOR THROUGH URBAN AGRICULTURE

Andres Dasso and Teobaldo Pinzas

1. Introduction

The capital of Peru, Lima, is located on an infertile sandy strip along the Pacific Ocean. The average rainfall is 0.0 mm. In this rather unlikely environment, attempts to use urban agriculture as an instrument to improve the living conditions of the resource-poor urban population have been implemented since the crises in the late 1980s.

Between the 1950s and 1990s, Lima experienced very rapid growth. This was due mainly to migration, not only from rural areas but also from smaller towns.

Table 1: ***Metropolitan Lima: total population (x 1000)***

	1961	**1972**	**1981**	**1993**	**1998**
Total Population	1,837	3,297	4,700	6,343	7,060

Source: Instituto Cuanto SA 1994

The migrants needed a place to live, resulting in mounting pressure on available land.
The city expanded in two ways - firstly, by the development of residential areas and commercial centres on the little agricultural land in watersheds, to cater to the needs of the richer classes able to sustain long-term investments; and secondly, through squatting by people with few resources, especially migrants. Squatting occurred mostly in desert areas on the fringes of the city.

The expansion was horizontal (individual houses) and not vertical (high-rise apartment buildings). As a result, Metropolitan Lima[1] covers a very large area, extending to over 2,800 km^2. Table 2 illustrates the process of urbanisation in the Rimac Valley, where Lima was founded, and in the Chillon Valley, which until 1940 was an exclusively rural area. This urbanisation continues today.

Table 2*: Lima and Callao: agricultural surface*[2]

Year	Rimac Valley				Chillon Valley			
	Agricultural area		Urban area		Agricultural area		Urban area	
	ha	%	Ha	%	ha	%	ha	%
1940					16,572	100.0	0	0
1964	27,275	84.6	4,958	15.4				
1969	23,334	72.4	8,899	27.6				
1976					10,262	41.9	6,310	58.1
1979	9,064	28.1	23,169	71.9				
1989	1,815	5.6	30,418	94.4	6,117	36.9	10,455	63.1

Source: Arroyo 1990

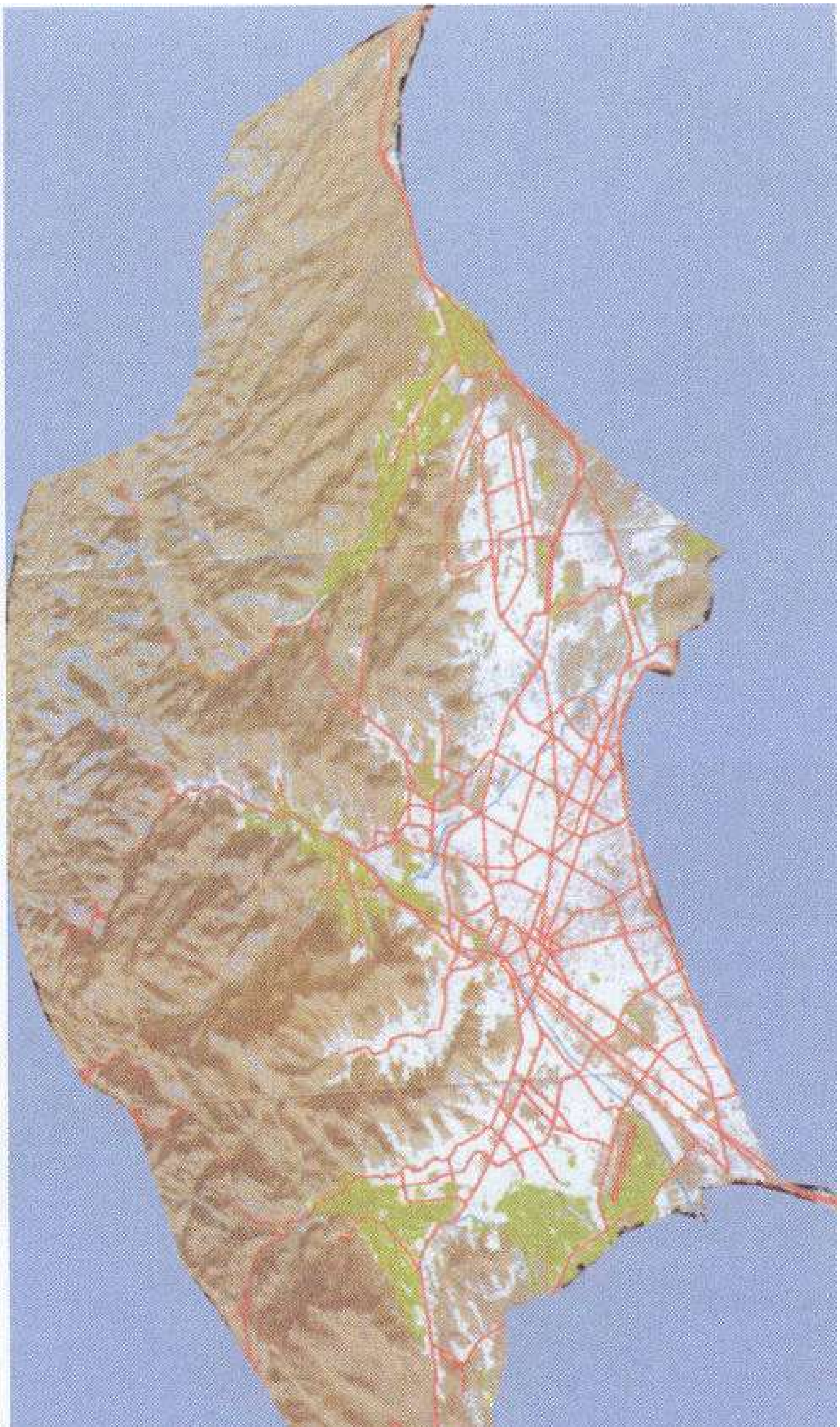
1.1 Demographic aspects

Nearly 30% of Peru's population or 7 million people live in Lima. The second biggest city, Arequipa, has an estimated population of only 696,900 inhabitants. The population density in Lima is approximately 2,600 inhabitants/km^2. Density varies from district to district[3], reaching a high of 27,972 in the old central district of La Victoria, an average of 14,274 in the central districts of Lima (La Victoria, Rimac and Brena) and an average 5,422 inhabitants/km^2 in the upper-middle-class residential districts (Miraflores, San Isidro, Surco, La Molina). Most migrants live in the *pueblos jovenes*, marginal areas, mostly former squatter settlements, with an average of 8,980 people/km^2.

Lima's work force is estimated at 3,373 million (1997). Employment figures (1995) indicate that only 16.6% of the economically active population is adequately employed and 76.2% is underemployed, while direct unemployment is relatively low: 8.8%.
The majority of Lima's labour force makes a living out of informal activities, mainly petty services, with low productivity and low incomes.

1.2 Presence of urban agriculture

In terms of production, periurban agriculture in Lima is by far the most important type of urban agriculture. It takes place in small plots around the borders of the city. However, even the periurban areas quite far from the city centres are under heavy pressure as the industrial and residential areas continue to expand.



Home gardens contribute to foodsecurity in the poorer quarters of Lima. The producers are mainly poor migrants to the city. (Picture Andres Dasso)

Guinea Pig breeding. The materials needed are cheap and locally available (Picture Andres Dasso)

The single most important crop is maize, grown both for human consumption and for cattle fodder (77% of the cultivated area). Other important crops are potatoes, sweet potatoes, onion, garlic, lettuce and various types of beans. Also some crops to supply different industries are grown: marigold (for the animal food industry) and cotton. Production costs are lower than those in intraurban agriculture. Cattle raising is also practised and can be quite profitable, especially when focused on producing beef for the Lima market[4].

2. NGO experiences in urban agriculture

Intraurban agricultural production will be analysed here as a strategy for improving the living conditions of poor urban households. In this section, the NGO (non-governmental organisation) experiences with community vegetable gardens, hydroponics and raising of small animals will be discussed.

2.1 Vegetable garden projects in slum areas

In the 1980s, when the country was severely plagued by economic crises, some ”assisted” experiences in urban agriculture were initiated. The projects were supported by NGOs and other institutions for social work and were targeted at low-income families. These families mainly live in the *pueblos jovenes* (slums). As a norm, the activities were heavily subsidised. The majority of these activities involved either family or communal vegetable gardens.

The objectives of initiating the vegetable gardens were:

- to improve food consumption, through home consumption of the vegetables;
- to increase income through the selling of produce, or both consuming and selling;
- to strengthen grassroots organisation, for which the vegetable projects were an instrument.

In the period 1984-90, Asociacíon Peru Mujer obtained grants for a project aimed at low-income women in the southern cone of the city. In 1987-95, the Ministry of Agriculture, with HUFACAM, formulated a national programme based on these experiences, which was implemented in several cities. Vegetable gardens were established in household plots, schools, hospitals and public spaces. A corps of women promoters was thoroughly trained and the project developed sets of training materials that were used to train participants in other groups in different parts of the country. Usually, the land for the gardens was located close to points of water supply.

People working in the gardens were poor or extremely poor. This limited their access to services. It was usually the women who worked the land together with their children. They were also responsible for selling the produce. A wide variety of vegetables were cultivated, as well as aromatic plants, herbs and potatoes. The size of the gardens ranged from 60 to 200 m^2. The gardens were on sandy soil, typical for this part of the city. The use of solid waste to produce compost was very common from 1980 to 1990. The gardens needed organic matter and fertiliser to improve their soils. No chemicals were used, and pests were controlled with domestic methods. The women were trained to do composting, using household leftovers, chicken and guinea pig dung, etc.

Irregular water supply is one of the main constraints for gardening in Lima. The groups had to organise themselves in order to ensure sufficient water. This was especially important in areas where a group had no access to the public network, and water had to be bought and kept in tanks. Tap water is no longer free since water gauges have been installed. Water fees have also become limiting factors. Free available irrigation water is readily noticed by vegetable growers. However, free water usually means untreated wastewater. Thus, part of the vegetables consumed daily by the Lima urban population comes from parcels liberally irrigated with untreated wastewater.

Usually, implementing vegetable gardens was part of a set of proposals by the assisting organisations to the local people. In most cases, however, not enough attention was paid to adapting the activity to the conditions of the families (skills, availability of physical space for the garden, labour time, access to adequate water supply). Despite many efforts to adapt and develop an adequate proposal for vegetable gardens, very few families continued after the project subsidy came to an end. On the basis of an evaluation, including interviews with staff of the NGOs involved in the projects, it has been argued (Pinzas 1994) that these vegetable gardens are not a sustainable alternative in the Lima context for the following reasons:

- limited availability of water in the project area; low-income families in particular face difficulties in ensuring sufficient water supply to their vegetable gardens;
- small household allotment, leaving very little space for adequate gardens;
- vegetables are not a prominent part of the families' normal diet; and
- above all, the opportunity costs of the gardens are high: "Families are better off trying to get a living from petty services; both in terms of money and food intake, growing vegetables is a less rewarding use of time."

In Lima, the *pueblos jovenes* have vast experience in popular organisation, such as community kitchens, the Glass of Milk programme, etc. In this sense, the community vegetable gardens certainly fitted in and contributed to consolidating the organisational levels of the groups. The home gardens also facilitated forestry programs of the Ministry of Agriculture, in which the protection of crops, green fences, wind curtains, etc. are promoted.

2.2 Experiences in household hydroponic production

In 1993, the Chile-based FAO Regional Office introduced a training package for what was called "popular hydroponics". Hydroponics is a technique of growing plants on water and hydroponic fibres to which necessary chemical nutrients are supplied. In response to this support, several initiatives started:

- since 1994, the Centre for Hydroponic and Mineral Nutrition Research (CIHNM) of the National Agricultural University La Molina (UNALM) implements outreach activities such as training courses and international workshops;
- some NGOs and schools now promote hydroponic production of vegetables for low-income people;
- some small-scale private firms engaged in the production of lettuce and tomatoes now use hydroponics. The produce is sold to the two supermarket chains operating in Lima. There is a small market in Lima for good-quality non-contaminated vegetables (and, to a lesser extent, strawberries). The buyers are aware of the health hazards of vegetables grown using heavily polluted water. The hydroponic produce is sold at a premium price, which can easily be twice as high as the price for ordinary vegetables. The market is thus restricted to higher-income consumers.

Two NGOs promote hydroponic production for poor families: CIDIAG (the Centre for Research and Development of Self Management) and Imagen Educativa. Each organisation designed a standard module for household hydroponic production. The modules are intended for small enterprises for the marketing of vegetables. Both men and women can be producers of hydroponic vegetables. The families use tap water from the public water-supply system. In the case of CIDIAG, tables covering a plot of 200 m^2 with 550 plants of tomatoes was designed. The total cost to establish this model is estimated at US$ 900. CIDIAG estimates that the sale of the tomatoes plus the produce of four “tables” of lettuce, at current prices, means a monthly family income of about US$ 200 which, in the Peruvian context, would be an important contribution. Imagen Educativa estimates the costs for establishing a production area of 150 m^2 of tables of lettuce at US$ 1,700. The costs for 80 m^2 for tomato production are estimated at US$ 900. Both NGOs, and CIDIAG, in particular, have adapted the technical package, in response to the difficulties confronting urban farming. The adaptations aim to reduce the required investment and the variable costs, as well as to make the management of production simpler.

Hydroponic production is rather complex and is considered more difficult than conventional vegetable growing. The poor families with limited skills and resources have difficulties in adopting the production technique. Careful training and permanent technical assistance have been indispensable. Most families involved in the projects are the descendants of migrants. Although their parents came from the countryside, they were born and brought up in an urban environment and therefore do not have a practical knowledge of agriculture. Besides, the idea of landless cultivation and technical management are very new to the farmers, and need explanation.

The preparation of the production site involves investments far above the financial capacity of the families. Both NGOs do look for cheaper and suitable alternatives for the inputs needed, with no charge to the producers for the time invested. NGO staff provide support in the acquisition of inputs and equipment, in selecting the most adequate alternative input, by buying in bulk, and by advising on the appropriate doses.
CIDIAG also sponsored research to substitute the standard nutrient solution based on chemical fertilisers. This resulted in a solution of humus appropriate for growing tomatoes. However, individual families have difficulties even to get hold of this.

CIDIAG designed the set-up so that the slope of the parcel is used to gravity-feed the solution to the vegetables (tomatoes), thus avoiding the purchase of an electric pump and timer. The hydroponic production of lettuce is done on tables, the single biggest investment cost. CIDIAG identified a source of cheap wooden planks (discarded cargo pallets), thus significantly reducing costs.

For those who succeed in managing the technology and are currently producing, acquiring regular access to markets poses a formidable challenge. Hydroponic production is more costly than vegetables imported from the rural and periurban areas. This restricts the market to relatively affluent consumers, who shop in supermarkets.
Supermarkets demand regular production of significant volumes of standard quality. On top of this, the producers need to have enough of a financial buffer. Supermarkets pay only about four weeks after delivery. All these conditions are difficult to meet for small-scale producers.

Imagen Educativa is directly marketing lettuce produced by the families participating in the project to a supermarket chain. The NGO has difficulties in achieving a regular supply of products of standard quality in sufficient quantity. Their scale of operations is very small; the total group size is 18 families, but the continuous supply for marketing is the produce of only two families each time. They have to compete with private firms engaged in hydroponic production.

Despite all the efforts to facilitate hydroponic production, the projects have been besieged by the desertion of participating families. After almost two years of project implementation, each organisation is now trying to consolidate a group of 18 families as hydroponic producers. Both projects will be extended for some time in order to consolidate the groups.

2.3 Production of small animals

Up to the 1960s, even within residential areas, raising small animals was quite common in Lima. Usually the animals were bought alive in markets and kept at home to gain weight and to be slaughtered for special occasions, like birthday parties and Christmas Eve. At the time, chicken was even more expensive than beef and other meat, and poultry consumption was not as common as it is today. From the late 1960s onwards, large chicken farms were established and the price of poultry products declined to the point that chicken meat now costs about one third the price of beef and is widely consumed (El Commercio, September 1999.)

Since then, raising small animals for household consumption has declined. However, a number of families still keep animals for food – on flat roofs, in backyards, etc., even though it is more expensive than buying in the market. This indicates that there are more than strictly economic reasons for raising animals[5].

More recently, a number of small firms appear to have engaged in the raising of quail. There exists a market for the eggs, mainly used as an ingredient in Chinese dishes, which are well-liked in Lima. The eggs are also promoted as a low-cholesterol alternative. The raising of quail does not demand a large space and is done both in entirely urban as well as in periurban areas. No estimate of volumes of production is available. Training courses to become a quail producer are currently advertised in the newspapers, and live birds can be easily bought in the markets.

The case of guinea pigs (v. *Cuy*) is different. Raising and consuming these animals is an ancient tradition in Peru, especially in the Andean highlands, where it is an appreciated part of regional cuisine. Consumption of guinea pigs is widespread, and the UNALM and INIA sell genetically-improved breeding stock.[6]

Three types of guinea-pig producers can be distinguished:

- *household producers:* the production is for home consumption and irregularly marketed. The families produce, on average, 10-30 guinea pigs;
- *commercial family system:* most family labour is absorbed and more sophisticated breeding techniques are used. The production takes place mainly in the periurban areas. The producers have constructed special sheds and keep, on average, 30-50 animals; and
- *commercial enterprises:* this activity demands considerable investment. Very sophisticated techniques and systems are used. The enterprises are located mainly in the periurban area.

The majority of producers in the first two groups are women. In the third group, however, the producers are almost exclusively men.

Raising guinea pigs has also been promoted by projects aimed at household food production. The idea was to feed the animals with kitchen waste. In many districts, organic waste is taken care of by informal collection systems. However, the idea did not really work, as the availability of kitchen waste was very limited and it had to be supplemented with special feed, thus becoming a burden on the household economy. Nevertheless, there is a real market for this meat, based on the large Andean migrant population that lives in Lima. Consumer markets are mostly catered for by periurban producers who can grow their own fodder and probably also by producers from other regions outside Lima. At the same time, there are families who raise their own guinea pigs, as can be deduced from the fact that grass can normally be bought in small quantities in district markets, brought in from the edge of the city and even further away on a daily basis. Guinea pigs should be considered a delicacy rather than a staple food.

3. Concluding remarks

A review of different experiences in urban agriculture focused on the urban poor in intraurban slums in Lima shows the limitations of the interventions in vegetable gardens and small-scale animal production aimed at supporting low-income families.

Although - without NGO or governmental interventions - a number of families do grow vegetables and even keep fruit trees and raise some animals (guinea pigs, chickens), diminishing availability of land, scarcity of water and pasture, and the development of the chicken industry reduce the importance and impact of these experiences.

Projects trying to engage poor families in hydroponic production should be adapted to the family's management capacities and technical knowledge, requiring a substantial training effort all along. Everything taken into account, these experiences are relatively very expensive and thus not easily accessible for poor families. Only very small groups benefit and all groups face serious problems entering the market.

From the perspective of amounts produced for the city population, periurban production stands alone as the principal system, using important areas around the city and supplying a significant share of the city's food consumption. The sector is under increasing pressure as a result of the expansion of the city, which may end up making Metropolitan Lima entirely dependent on supply from producers from rural areas.

At the same time, there are small-scale private firms engaged in organic vegetable production, hydroponics, production of quail eggs, mushrooms and – more recently – aromatic plants for the huge Lima market, both inside the urban area and on the edges of the city. This small but expanding sector needs further investigation.

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1 Metropolitan Lima includes the Province of Lima, with 43 districts, and the Constitutional Province of Callao, with 6 districts. Together, they constitute a single urban entity both physically and economically, however with two provincial governments.

2 This figure does not include the Lurin Valley and uses a more restricted definition of the area of Lima, leaving out the districts of Chosica and Lurigancho, where large agricultural areas are found.

3 Estimates based on the 1993 census.

4 Areas like Lurin are used by entrepreneurs who keep cattle bought from faraway peasant families, several hundred kilometres away, and fed until the animals reach a commercially interesting weight. Slaughterhouses have been established in Lurin and Ate in the Lima Valley.

5 Also a special breed of fighting cocks is raised. The volumes are not very big, but there are regular breeders all over the country, including in Lima.

6 Currently IDRC (the International Development Research Centre) supports a project conducted by INIA specialist Lilia Chauca.

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URBAN AGRICULTURE IN LONDON: RETHINKING OUR FOOD ECONOMY

Tara Garnett

1. Introduction

London's food system exemplifies and symbolises its fundamental unsustainability. The city's ecological footprint is 125 times its surface area, requiring the equivalent of the entire productive area of Britain to sustain itself; each year, Londoners eat 2,400,000 t of food (Girardet 1995). Twenty-nine percent of vegetables and 89% of fruits are imported (MAFF 1998); in 10 years the amount of food transported along UK roads has increased by 22% and the average distance travelled by 46% (DETR 1998g). London creates 883,000 t of organic waste a year (Murray 1998), of which households contribute 607,000 t or 40% of their total waste. The vast majority is landfilled, creating polluting leachate and methane (Murray 1998). This said, around 37% of the households compost at least some waste (DETR 1998e), though how much is not clear.

The food industry contributes significantly to the city's GDP (gross domestic product), and accounts for 11% of total jobs (Heasman & Rumfitt 1996). However, the jobs are generally poorly paid and of low status. Four supermarkets account for 67% of food purchases (Mitchell 1998). The London farmer is a dying breed and most commercial agricultural activity is chemical-intensive.

Table 1: ***Basic facts and figures***

	The United Kingdom	**London**
Area	242,910,000 km^2	1578 km^2
Population	58,801 million	7 million
Density	242 people/km^2	4,480 people/km^2
Population growth	3.5% between 1987 – 1997	4.6% since 1988
Urban population	89% on ca. 7.7% of the land (Comedia/Demos 1995)	
Main economic sector	Services (Office for National Statistics 1999)	Financial and business services
Main employment sector	Services (ONS 1998)	Services - particularly arts, leisure and tourism
Agricultural workforce in % of population	2%	0.04% (around 3000 people)
Climate	Temperate	Temperate

The agricultural work force is ageing. Only 2% of the UK population is directly involved in farming (Hird 1997) with a further 60,000 people in commercial horticulture (Lantra 1998). Young people are moving to the cities to find decent jobs and living conditions (Hird 1997).

Related to the above are the diet of the Londoners and their physical and mental health. Eating more fruit and vegetables could reduce cancer by 20% (World Cancer Research Fund 1997) and heart disease by 30% (British Heart Foundation 1999). Obesity, heart disease and diabetes afflict the poorest most (Leather 1992), particularly black and Asian people (Anon. 1995). Such disease rates are much higher in deprived areas (Bardsley & Morgan 1996) where healthy food is neither accessible nor affordable (DETR 1998a). Many housing estates are “food deserts” without shops selling fresh vegetables (DETR 1998a). Processed, fatty, sugary food is disproportionately cheap (Lobstein 1997).

The dependence on a globalised food economy is also disconnecting us from nature. While 93% of British children know how to play computer games, only 54% can boil an egg (MORI 1993). Mental illness is another concern (The Health of Londoners Project 1998), reflecting the inherent unsustainability of our lifestyles. Never before have we been so interested in food. Never before has there been so much choice. At the same time, thinness is portrayed as the ideal, and anorexia and bulimia are increasing.

More positively, the current debate around the genetic modification of foods has catalysed enormous public concern and may ultimately favour the organic movement. Organic food sales are rising dramatically[1] (Soil Association 1998) and marketing alternatives to the supermarket are proliferating.

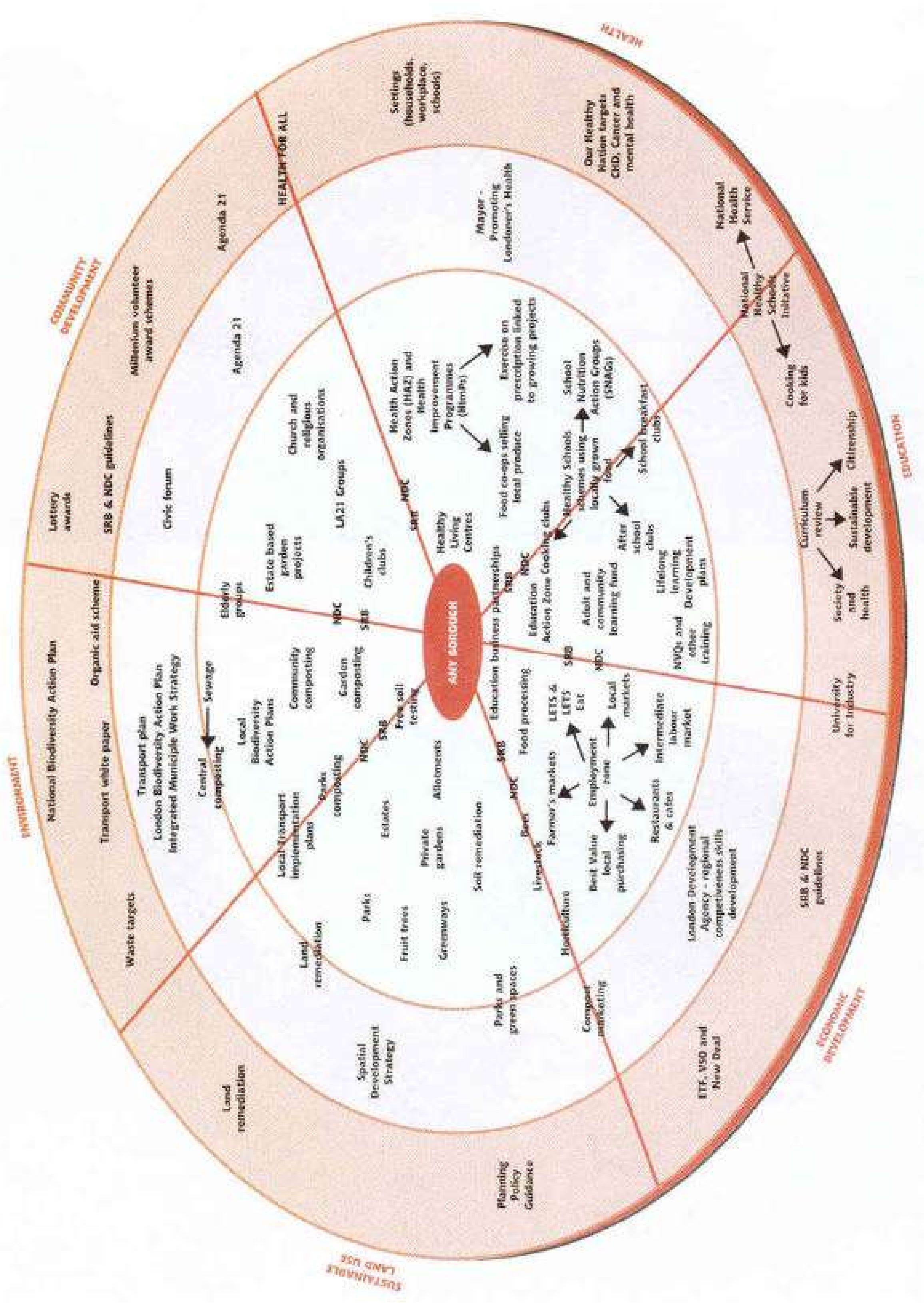
2. Urban food growing in London

London contributes very little to the total UK food supply, but the range of activities and foods grown is broad.

2.1 Agricultural activities

2.1.i Commercial farmland

There are 13,566 ha (MAFF 1997) of farmland on the Greater London fringe. This area is in decline (London Planning Advisory Committee 1995) on account of development pressures. The requirement to reduce production means that agricultural land is increasingly put to set-aside, or other uses. 500 ha are under fruit and vegetables, contributing £3 million to the economy (MAFF 1998)[2] and employing about 3,000 people (ONS 1998)[3].


ENVIRONMENT
COMMUNITY DEVELOPMENT
HEALTH
EDUCATION
ECONOMIC DEVELOPMENT
SUSTAINABLE LAND USE
HEALTH FOR ALL
ANY BOROUGH
National Biodiversity Action Plan
Transport white paper
Waste targets
Organic aid scheme
SRB & NDC guidelines
Lottery awards
Millenium volunteer award schemes
Agenda 21
Civic forum
Settings (households, workplace, schools)
Our Healthy Nation targets CHD, Cancer and mental health
National Health Service
National Healthy Schools Initiative
Cooking for kids
Curriculum review
Citizenship
Sustainable development
Society and Health
University for Industry
SRB & NDC guidelines
London Development Agency - regional competiveness skills development
ETF, USO and New Deal
Planning Policy Guidance
Land remediation
Spatial Development Strategy
Parks and green spaces
Compost marketing
Transport plan
London Biodiversity Action Plan
Integrated Municiple Work Strategy
Local Transport implementation plans
Mayor - Promoting Londoner's Health
Health Action Zones (HAZ) and Health Improvement Programmes (HImPs)
Food co-ops selling local produce
Exercise on prescription linked to growing projects
School Nutrition Action Groups (SNAGs)
Healthy Living Centres
Education Action Zone Cooking clubs
Adult and community learning fund
Lifelong learning Development plans
NVQs and other training
Food processing
Farmer's markets
Employment zone
Restaurants & cafes
Intermediate labour market
Local markets
Best Value local purchasing
Horticulture
Livestock
Soil remediation
Allotments
Private gardens
Greenways
Fruit trees
Parks
Estates
Parks composting
Garden composting
Community composting
Central composting
Sewage
Local Biodiversity Action Plans
Elderly groups
Estate based garden projects
Children's clubs
LA21 Groups
Church and religious organisations

City farm (Picture Sustain)

Allotment gardening (Picture Sustain)

Horticulture takes place mainly in the Lea Valley area, which extends northeast 30-40 km beyond central London. Here, glasshouses produce salads, vine crops, and non-edible plants (Lea Valley Growers Association 1993). While larger enterprises are surviving, smaller ones are struggling - a familiar situation across the agricultural sector.

2.1.ii County farms

Some outer London authorities still own farms. Although run as commercial enterprises, some also host occasional school visits. Council-owned farmland is also leased out to individual tenants, often through commercial property managers.

2.1.iii Allotments

There are around 30,000 active allotment holders gardening on 831 ha of land, of which 111 ha are in inner London (Crouch 1997). In inner London, 4% of the total is vacant, and there are long waiting lists for plots. In outer London, the vacancy figure stands at 18% (Crouch 1997), reflecting perhaps the fact that many houses in the area have large gardens. Allotment sites are largely owned and managed by local authorities, which have a duty to provide, maintain and promote them. Inner London authorities, while exempt from this duty, often provide allotments, and some privately-owned sites (6% are owned by railway and other companies) are also available. (Crouch 1997). Allotments have been protected by law since 1908 and the government has recently joined local authorities to *promote* in addition to simply providing for allotments. Traditionally, allotment gardening has been a past-time for low-income or retired men. In 1993, only 6% of plot holders in the UK were under 35, and 65% were over 50. This is changing: new entrants are often younger and from higher occupational classes (Crouch 1997).

2.1.iv City farms and community gardens

The City Farms movement began in the 1970s. There are 65 in the UK, with 8 in London ranging from 0.25 to 2.5 ha in size. Although there is usually some horticultural production, animal keeping predominates. City Farms tend to be funded through charitable and municipal sources and managed by the local community. City farms serve primarily a community and educational role. For many urban children, a visit to the farm is the first time they encounter agricultural animals and food growing in the ground.

There are 77 community gardens in London affiliated to the Federation of City Farms and Community Gardens (FCG & CG) and there are likely to be others which are not affiliated. They are located throughout the city, on housing estates, near railways, on temporary land and in community centres. Community

gardeners grow mainly flowers and ornamental plants, although some food growing takes place.
Together, London's city farms and community gardeners draw in around 650,000 visitors a year, about 10% of London's population (FCF & CG 1999).

2.1.v Private gardens

Half of London's 2.8 million households have gardens (London Pride Waste Action Programme 1997). Together, they comprise nearly 20% of Greater London area (Dawson & Worell 1992) or 30,455 ha. Research indicated that 14% of the London's garden area was allocated to fruit and vegetable production in the 1950s (Wibberley 1959) but it is unlikely that the present day matches anything like this amount.

2.1.vi School gardens

Some schools have dug up the tarmac of their playground and created small growing beds. The amount they grow is usually minute, and the purpose is educational rather than nutritional.

2.1.vii Orchards

The European Common Agricultural Policy has dramatically reduced the number of orchards. Currently, there are around 15 orchards in and many more around London (Common Ground 1999).

2.1.viii Parks

Parks serve primarily a recreational function and, as such, there may only be a limited role for individual food-growing activities. Nevertheless, there are a few community food-growing projects in London's parks, often located near management buildings.

2.1.ix Temporary/vacant land

Officials can be cautious about letting people use temporary land for fear of gardeners resisting relinquishing control to developers. However, there are community gardens located on such land.

2.2 Urban agricultural production

2.2.i Actual contribution

Roughly 8,400 t of vegetables are produced commercially, 7,450 t[4] from allotments and 27 t of honey from bees. The amounts of vegetables, meat, milk and eggs from gardens, community orchards and city farms are unknown.

2.2.ii Potential contribution

Estimates of the proportion of various land types, which could be made available, combined with an estimated "average yield/ha" gives a rough indication of the potential production. The calculation is based only on fruit and vegetable production; other agricultural uses would generate different results. The calculation does not take into account the potential yields from window boxes, rooftops, street fruit trees and other areas where food could be grown.

Table 2: ***Potential vegetable and fruit production in London***

Land type	Land area	% for urban agriculture	Area for urban agriculture
Agricultural land	13,566 ha	50%	6783 ha
Other greenbelt land	[5]40,034 ha	20%	8007 ha
Allotments	831 ha	100%	831 ha
City farms	51 ha	[6]25%	13 ha
Community gardens	20 ha	25%	5 ha
Public open space	14617 ha	5%	731 ha
Derelict/vacant land	1388 ha	1%	14 ha
Gardens	38,014 ha	[7]14%	5322 ha
Total	**108521 ha**	**20%**	**21706 ha**

Using a productivity level of 10.7 t/ha[8], London could produce around 232,000 t of fruit and vegetables. Taking the WHO recommendation to eat 0.5 kg of vegetables and fruit a day, the amount potentially available would supply Londoners with 18% of their intake.

2.2.iii Marketing

Most of the produce grown in the Lea Valley is bought by supermarkets, which distribute it across the region. Home-grown produce is either eaten by the growers and their families or shared among friends. Some is exchanged through local exchange trading schemes (LETS).

2.3 People and organisations involved in urban agriculture

2.3.i Organisations

The National Society of Allotment and Leisure Gardeners represents and promotes the interests of allotment gardening since 1930. Almost all city farms are affiliated to the FCG & CG, which works to promote their interests. The charity Common Ground promotes the "community orchard" (small, locally-managed organic orchards). The Lea Valley Growers' Association represents commercial horticultural production in the Lea Valley. The Permaculture Association of Britain promotes sustainable food growing, both urban and rural. The Soil Association, which promotes organic agriculture, supports urban food production as part of its campaign to promote “local food links”. The Henry Doubleday Research Association (HDRA) runs a “Grow your own organic fruit and vegetables” campaign, while Thrive promotes gardening of all kinds as a form of therapy. The Allotments Coalition Trust has recently been set up to promote allotment gardening. Sustain’s[9] City Harvest project works to promote and research food growing in London.

2.3.ii Gardeners

Gardening is extremely popular[10]: 4/5 of British adults claim they are gardeners and 39% describe themselves as keen (Gardening Review 1997). Fourteen percent of Londoners grow some fruit and vegetables; this rises to 21% among the over-65s and falls to 5% for the 20-24 year- olds (Gardening Review 1997). People with higher incomes are more likely to grow their own vegetables (18%) than people in the lowest income groups (11%).

3. The role of urban agriculture in sustainable development

Much of the evidence on the benefits of urban farming is anecdotal; however, it does suggest that urban agriculture may well make a positive contribution to London’s overall sustainability. It also points towards what urban food growing *could* achieve.

3.1 Urban agriculture and health

3.1.i Current contribution

One national survey shows that allotment growers believe gardening improves their health (Saunders 1993). Also, US research suggests that food gardeners consume more fresh produce and enjoy better physical and mental health than non-gardeners (Anon. 1991).

The therapeutic benefits of horticulture are increasingly recognised. The charity Thrive lists 136 gardening projects with a mental health remit in London. Examples are the *Natural Growth* project in North London, which works with asylum-seekers and victims of torture, and the *Healing Gardens* project, which works with terminally and chronically ill clients. Some people find that it is the solitude of the allotment and the chance to get away from the stresses of life which is essential to their well-being (Crouch & Ward 1994).

The perceived health risks of eating urban produce can constrain people’s involvement. While there has been little UK research on this, a study of vegetables grown on allotments near sources of heavy metal pollution concluded that "the dietary intakes of these elements are not a cause for concern" (MAFF 1998). Balanced against the potential dangers of eating urban produce are risks from vegetables on sale from commercial rural farms (MAFF 1997)[11]. Nevertheless, the risks from soil contamination should not be underestimated.

3.1.ii The potential

There is growing interest among UK policy-makers and practitioners in the role of urban agriculture in promoting health. The potential of allotment gardening is considered in the Government's policy paper *Our Healthier Nation* (Anon. 1998). There are also numerous Government health-oriented schemes (e.g. Health Action Zones, National Healthy School Schemes, Healthy Neighbourhood and Work Schemes) which stress the importance of community involvement and a holistic approach to health. One Health Action Zone in East London will incorporate food growing into its cardiovascular disease prevention programme.

3.2 Urban agriculture and the environment

3.2.i Current contribution

The mainly hydroponics-based commercial horticulture in the Lea Valley is highly energy-intensive (Lea Valley Growers Association 1993, 1999) and most produce is sold to supermarkets which distribute on a centralised basis. Non-commercial food growing presents a mixed picture. One national study suggests that 38% of allotment growers drive to their plots, 75% use insecticides and one-third, weed-killers (Saunders 1993). This may negate the environmental contribution they make by growing the food. Many other growers, however, walk to their plots, compost their waste, and garden organically. Many community food-growing schemes have clear environmental aims: to promote biodiversity through organic growing, to reduce waste through recycling and composting, and to minimise food transportation through local food production.

There is a fast-growing interest in organic gardening (HDRA 1999). Food seems to catalyse environmental concern, indicated by the rise in organic food sales. Nationally, chemical use in gardens is growing[12] (British Agrochemicals Association 1993, 1999), on account of herbicides used on lawns and hard surfaces. Meanwhile, insecticide and fungicide sales - more likely to be used by food growers – have reduced from 440 t in 1992 to 266 t in 1997.

Composting is a major environmental benefit of food-growing schemes. One South London survey suggests that 70% of allotment gardeners compost their waste, compared with just 30% of household (largely non-food growing) gardeners (Community Recycling in Southwark Project 1999). Food growers

also reduce their non-food waste by substituting own grown vegetables for packaged foods. As half the households in London do not have a garden and most people have no allotment, community composting on communal land is an alternative. A number of such schemes are already being developed on housing estates in London, but they face a number of logistical and motivational problems (*Ibid.* 1999).
Centralised composting schemes can deal with larger quantities. One Council in East England provides households with a separate bin for organic waste, which it picks up along with the ordinary waste (Murray 1998). There are two municipality-run schemes in South London and four bordering the city, which only compost green (non-food) waste and which sell the compost through garden centres. However, these schemes incur environmental costs, as the waste is trucked in from across London.

Sewage is another untapped source of compost. Thames Water produces and sells more than 30% of the anaerobically-treated sewage used in UK agriculture, and small quantities of sewage-based compost which it markets through garden centres. In1996, Thames Water spread 37,000 t of sewage onto farmland (Evans 1996). Aerobic treatment and subsequent composting can produce a better product and is perfectly safe as a medium for food growing (National Composting Association 1999). In 1997/8, London[13] produced 117,000 t in dry weight (Symons 1998), of which around 78,000 t was dumped into the North Sea; as this option has recently been banned, Thames Water will now be burning this. Many technical and logistical problems must be overcome if London is to develop a composting strategy for all its green, food and sewage waste. These are not insuperable, however, given political will and adequate funding, and both will be needed by 2000 when the EU directive banning the landfilling of untreated waste becomes law (Murray 1998).

Experiments show that urban food production can play a significant role in reducing food transportation[14]. Organically managed, productive allotments can also promote urban biological diversity, as can unused sites which harbour wildlife (London Wildlife Trust 1998).

3.2.ii The potential

A range of schemes could further food growing. For instance, part of landfill tax revenue is earmarked for projects which benefit the environment. So far, £70 million has been channelled in this way, some to composting schemes (Waste Watch 1998). The Environmental Task Force, a government training scheme, also offers potential for food-growing activities.

3.3 Urban agriculture and the formal and household economies

3.3.i Current contribution

London's agricultural sector is squeezed between development pressures and a skewed system of agricultural support which favours large cereal producers over small growers. This is not a vision easily applicable to inner city London. Horticultural growers receive lower levels of agricultural support than any other farming sector (Hird 1997) and organic horticultural growers suffer from further obstacles.

There are no commercially viable community food projects in London; all rely on grant funding, volunteers or both. Although allotment gardening traditionally combined recreation with a means of supplementing the household budget, monetary savings are not considered important by most gardeners. Those new on the allotment scene tend to be younger, more educated, professionals (Saunders 1993). This suggests that, for future generations, cost savings are likely to be even less important.

Food production still saves people money, whether they value this or not, if input costs and output value are compared. For this reason, some organisations started community food-growing schemes with the aim of involving low-income groups. This has often proved difficult. Arguably, the middle-income groups have gained most from the informal food economy.

Community food growing does not appear viable in strictly economic terms, but the health and social benefits which such schemes yield can reduce the burden on welfare services. Added to these are the environmental gains and the costs avoided by engaging people in leisure activities which are *not* damaging. Moreover, a study suggests that, for every £ an organisation invests in a volunteer, it gains between £2 and £8 of work (NEF & FoE 1998).

3.3.ii The potential

London's warmer microclimate and nearby markets mean that a food strategy for London could make a real contribution to London's regeneration and economic development. Salads, early season vegetables, "exotics" such as aubergines, unusual varieties and herbs perhaps yield most economic potential. While most job opportunities will come from sustainable agriculture on the urban fringe, there is room in the inner city for training schemes and alternative food-related economic activity.

There could also be a role for beekeeping. London will never be a major producer, but it could become a showcase for innovation and best practice, catalysing the revival of our flagging national bee industry.

Honey production

There are about 1,000 beekeepers in Greater London (Morton 1998). Yields vary from 8 to 30 kg per hive. Urban hives produce more than rural hives, because cities are home to countless plant species from all over the world (Carreck & Williams 1998). As a rough estimate,[15] London produces 27,000 kg of honey annually (10% of total consumption) valued at £15.7 million (Stenhouse 1998). British honey commands high prices in niche markets. Beeswax has an additional market value of £120,000, and honeybee crop pollination is worth £167.6 million (Carreck & Williams 1998). Beekeepers enjoy significant support from the MAFF, including free hive inspections and information (Carreck 1998).

Mushrooms also use limited space and some varieties can command high prices. In the UK, the gourmet mushroom industry is embryonic; over 99% of demand is met by imports (Young 1997). However, a pilot shiitake mushroom project underway in a deprived area of Glasgow in Scotland aims to be financially viable within five years, able to support up to three jobs and with annual mushroom production reaching 6,900 kg (Young 1997).

Primary production could further the development of cottage food-processing industries, making preserves, dried foods and so on, as some community projects are already doing. Food could be sold through box schemes (where subscribers pay for a mixed box of seasonal organic produce), LETS and the increasingly popular farmers' market, the first of which was launched in London in June 1999. While this will attract producers from beyond London, it could also provide a supportive environment for urban producers to develop their enterprises. Government could also implement policies to assist market development; e.g. local authorities could specify local sourcing in their contracts with caterers who service municipal canteens.

The composted value of London's organic waste could reach as much as £6.1 million in sales (London Pride Waste Action Programme 1997) and generate 350 full-time-equivalent jobs. Composting would save London £55 million annually on collection and disposal costs and would cost an estimated £40 million a year, meaning a net benefit of £15 million. Added to these are the environmental savings (Murray 1998). There could be additional jobs in equipment manufacturing, promotion, education and training.

3.4 Urban agriculture and education and training

3.4.i Current contribution

Although food-growing activities in schools are uncommon, those who do have such schemes have noted significant benefits. Gardens have improved the school morale, raised health and environmental awareness, catalysed more parental involvement in school life and contributed to curriculum education. Most gardening activities are at the primary level, although there are some initiatives which involve university students.

One development education centre in East London runs a Global Footprints project. This invites children to examine the impact of everyday actions - including food and food growing - on the wider environment. As many pupils are of Bangladeshi origin, the project has established links with schools in Bangladesh. In time, the project will be extended to high schools and to other areas in the UK, Europe and the South. City farms, too, have enormous educational potential. Each year, they are visited by thousands of children - 3,000 to 12,000 per farm, according to one informal London survey (FCF & CG 1999).

For adults, there are several food-related training schemes in London (Capel Manor 1999). The Hoxton Trust in East London provides training for unemployed people, of whom many suffer from mental health problems. Food production is not specifically part of its remit, but many of the project benefits would also apply to food-growing schemes. The training has improved participants' behaviour, literacy, morale and punctuality. All these contribute to their prospects of securing jobs, in either related or unrelated fields. There are also several horticultural schemes for people with learning difficulties. These enable trainees to learn new skills and can lead to future work.

3.4.ii The potential

Urban food production has potential to promote learning for people at all ages and at all levels. One survey shows that 70% of teachers believe that environmental education should be mandatory (MORI 1998). The school curriculum is highly prescriptive. There is provision for food growing and only a limited requirement (for younger children) for food and nutritional education. However, the national curriculum is being revised and is likely in the future to make stronger provision for citizenship, health and sustainable development education - all of which could benefit from links with food growing. The Education Action Zone, a new government scheme (DfEE 1998), brings schools, business and community organisations together to develop innovative ways of learning. Again, food growing could play a part here.

Indeed food growing could facilitate learning in a variety of school subjects, from maths (plot measurement, calculating yields) to science (plant biology, soil structure) to history (the role of food in trade and conflict) and to linking with information technology (computers could be used to design sites). Pupils could develop the food-growing activities as a business, marketing foods to parents and the community, in line with the government's aim of promoting business school links.
In addition to school learning, the government is committed to widening adult participation in learning and to skills development. Sustainable food growing can be very challenging whereby the limitations of a city pose extra challenges. What is more, all successful food businesses require the management and often information technology skills, which the government is keen to see developed.

The newly developing intermediate labour market (ILM) model offers scope for food growing. This provides a training and waged-work programme which, although more expensive than many mainstream training programmes, has been significantly more successful in placing people in full-time work. There are also opportunities for developing more horticultural training for people with disabilities, enabling them to develop work-relevant skills and to pursue a rewarding activity. However, any training schemes must go hand-in-hand with job opportunities. There is little point in providing training without start-up support and access to the necessary land. Effective promotion must present urban agriculture as an industry with a future, combining idealism with pioneering innovation and genuine financial opportunities.

3.5 Urban agriculture and community development

3.5.i Current contribution

Many of the community food-growing projects in London have undoubtedly helped improve participants' quality of life, such as the Healing Gardens and Natural Growth projects which have enabled marginalised people to come together, develop skills, confidence and friendships.

The Dartford Road allotment site just beyond Greater London in Kent has grown into a hub of community activity. It is now so popular that there is a waiting list. Social events such as barbecues attract many people, and reciprocal arrangements such as bulk-buying and sharing manure are common (Dartford Roads Allotment Association 1999). Many food growers, in turn, contribute directly to others in society and to the environment. Almost all community projects rely heavily on volunteers. Many allotment gardeners help each other with the work, or share produce[16].

However, it also occurs that others in the neighbourhood might prefer to see the land put to an alternative use. One "community" food-growing project outside London was pressurised by the surrounding community to close.

3.5.ii The potential

*The g*overnment puts great emphasis on the importance of "the community". It has launched a number of area-based schemes in deprived areas aiming to tackle specific local problems. These include the Single Regeneration Budget (SRB) and the New Deal for Communities (NDC) schemes, which combine efforts to create employment, to reduce crime and to improve housing with an overall objective to stimulate community life. London is full of regeneration schemes[17]. These may well provide openings for food-growing projects. The SRB scheme has already funded food-growing activities elsewhere in the UK and some NDC plans mention food growing. The government has already recognised the value of allotments to Local Agenda 21 (LA21) (MAFF 1998a) which offers further scope for urban food growing. Most local authority areas in London have a LA21group, bringing people together to improve their environment.

4. Factors affecting urban agriculture

A sustainable food strategy for London will require a total rethinking of our food economy. At present, national agricultural policies and the European Common Agricultural Policy do little to promote sustainable rural production, let alone urban food growing. Despite the proliferation of forward-thinking schemes, their impact must be measured against the trends towards corporate globalisation which government favours and seeks to promote. Many of these initiatives will have little effect on poverty forecasts compared with the impact of macro-economic policies on peoples' lives (Kleinman 1998).

Land is scarce in London. It is also expensive and urban agriculture is not the most lucrative way of using it. Many councils are under great pressure to sell sites to developers (on the basis of no demand for plots) to raise funds and meet housing targets. Nevertheless, there are sound arguments for preserving London's open spaces, as the government acknowledges, advising local authorities that in "meeting London's housing need, full account must be taken of the value of existing public and private open space" (DETR 1996).

However, much food growing can and does squeeze into land which is too small for other uses. Such activities can, in fact, make better use of land such as parks, land surrounding housing estates and gardens, which have already been designated as green space but which are neglected or underused. Food growing on interim land is also an option. Government strategic guidance states that green spaces "where public access is restricted or not formally established but which contributes to local amenity or … recreational needs [are] valuable" (DEDT 1992).

Although scope for developing commercial horticulture is greatest on the urban fringe, much of this land is degraded (DEDT 1992) and alternative uses for it can be more commercially attractive. Land is often owned, managed and used by a range of different bodies. Faced with this patchwork of ownership, the logistics of devising a coherent agricultural policy framework are complex.

Land contamination is another serious potential problem. It is estimated that the total cost of identifying and cleaning up contaminated land in the UK could be as high as £10 billion (FoE 1998). In London, nearly 60% of vacant industrial land (over 500 ha) is contaminated (London Planning Advisory Committee 1995). It may also be that many allotments, gardens and other pockets of land are too polluted for safe food production. The problem is that nobody really knows.

Although Government has allocated £110 million for identifying and cleaning land throughout the UK (DETR 1998), funding for food growing is unlikely to compete favourably with the many other development options which do not require such thorough remediation. If, then, community organisations want to ensure the land is safe enough to eat off of, they will have to test and clean it up themselves. To do so, food growers desperately need adequate information - at present unavailable - in order to carry out the necessary work. However, advocating soil testing too zealously could work against community food growers, who could suddenly face eviction from their gardens by land-hungry property developers on the grounds that the land is "a health hazard". While it is essential to make sure our land is safe, we should be careful not to throw the baby out with the bath water.

5. Perspectives for the development of urban agriculture in London

There are positive foundations on which to build. An estimated 14% of Londoners already grow some food; 30,000 Londoners are active allotment gardeners; countless more participate in other gardening activities or visit city farms. Many organisations are already growing food or working to promote this. Public awareness of food and environmental issues is growing. These individuals and organisations could be brought together to work towards and argue for more support for urban food growing. Such support would require:

- national policy-makers across all departments to work together to develop a national sustainable food-growing strategy, encompassing financial and other support, promotion and research for, among other things, urban agriculture;
- the Greater London Authority to develop a sustainable food-growing strategy for London, coherent with the national strategy and embracing all the Authority's functions and responsibilities; and
- policy-makers at all levels and across all departments to integrate food growing and its promotion into their aims and activities.

This paper has already highlighted various schemes and policies which could potentially support urban agriculture. In turn, urban agriculture offers the "joined up solutions to joined up problems" (MAFF 1998a), rendering the numerous benefits already mentioned.

The new Greater London Authority (GLA) will have responsibility for co-ordinating action on the environment (DETR 1998). This will include promoting sustainable development in transport, spatial development and economic development; developing an air-quality strategic plan and a municipal waste strategy; and promoting Local Agenda 21 and biodiversity. Food growing could help the GLA achieve many of these objectives.

Local, organic food production of the kind advocated here is a textbook example of holistic thinking, spanning and integrating economic, social, health and environmental issues. The evidence suggests that, as the innermost ring of "food circles", urban agriculture could make a significant contribution to a more sustainable food system, supplying London with fresh, seasonal, organic produce while creating jobs and promoting health.

However, sustainable food growing is about more than this. It is a metaphor for social change, catalysing new ways of thinking about our society, our economic system and the environment on which we depend. Ultimately, a food-growing strategy for London could span the outer and inner city, the formal, informal and household economies, and encompass primary production as well as processing, marketing and composting. In this way and in time, London could establish itself as a "seed bed" or centre for horticultural and food excellence; a sustainable blueprint for other towns and cities to adopt.

1 From £100 million in 1993 to £260 million in 1997.
2 Extrapolation from national average productivity levels.
3 This figure combines the farming, forestry, hunting and fishing sectors.
4 Estimate provided by the National Society of Allotment and Leisure Gardeners/FCF & CG, January 1999. The figures are based on research by the Royal Horticultural Society in 1975. As these yields were an example of "best practice" not achievable by all, the productivity rates are halved here to a level of 10.7 t/ha. The figure includes only occupied allotments and not those which are vacant or derelict, leaving a cultivated area of 697 ha.
5 Total greenbelt area of 53,600 ha minus the 13,566 ha of agricultural land already listed.
6 The educational role of city farms means that land for classrooms and animals take up much of the farms' area; as such, fruit and vegetable production is always likely to take a back seat.
7 Based on an average area of garden land devoted to food production in 1951 (Wibberley 1959).
8 Based on FCF & CG / National Society of Allotment and Leisure Gardeners calculation given above.
9 Formerly the SAFE Alliance and the National Food Alliance.
10 As illustration: there are gardening programmes on the television at peak viewing hours almost nightly.
11 A MAFF study showed that samples of lettuce and spinach contained nitrate levels exceeding allowed limits.
12 From 1,354 t of active ingredients in 1992 to 2,285 t.
13 Defined here as the area within the perimeters of the M25 motorway.
14 A Californian study indicates that 0.42 ha can meet virtually all individual's food needs, providing space not just for growing but also for composting and other activities. Thus, relatively little land is needed to create an ecologically closed loop.
15 Based on an estimated 1,500 hives in London (many beekeepers have more than one) and an average yield of 40 lb of honey.
16 An American survey (Anon. 1991) suggests that community gardeners are more likely than non-gardeners to participate in food distribution and environmental schemes, as well as social events.
17 Since 1992, £277 million of government funds have been injected into the deprived borough of Tower Hamlets (Wright 1999).

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MEXICO CITY: THE INTEGRATION OF URBAN AGRICULTURE TO CONTAIN URBAN SPRAWL

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1. Introduction

The Mexico City Metropolitan Zone (MCMZ) covers an area of 7,860 km^2 and includes the Federal District and 54 municipalities (Programa 1983 cited by Delgado 1994). Mexico City (Federal District) is located in the Valley of Mexico, at the centre of the Mexican highlands. It extends over 1,479 km^2, has an average altitude of 2,238 m above sea level and is surrounded by mountains of up to 3880 m. The main soil types are litosoles, andosoles, feozem, regosoles and solonchak (CETENAL 1977). The climate is temperate, with summer rains. Mean temperature ranges between 18ºC and 24ºC, and average annual rainfall ranges between 100 and 1,400 mm.

Approximately 22 million inhabitants live in the MCMZ, 10 million of them in the Federal District. Over the last thirty years, three main zones of population concentration were formed within the Federal District:

- *Urban Nuclear Zone:* six centrally located districts in a traditionally urban zone, where housing is making way for office buildings, industry and cultural services. The population density, which used to be high, has been decreasing as a result of migration to the periphery**;**
- *Rural-Urban Fringe:* the six most rural districts are located to the south and east of the Federal District. This area has the lowest, but a markedly increasing population density. The increase was mainly at the expense of agricultural land and was followed by an increase in residential zones, tourism and services; *Intermediate Urban Zone*: this is a heterogeneous area. These districts have experienced a rapid increase in their populations since the late 1970s, which resulted in both ordered and disordered (shanty) settlements. In particular, all of Iztapalapa and Alavaro Obregón have been the main sinks for large peasant migratory waves. Within these zones, some remnant agricultural production exists, albeit of little economic significance, as the zones are practically completely urbanised. Many of the settlements are relatively recent. The districts house most of the population within the Federal District. The majority of these settlements have been established on the least suitable

areas, including ravines, old lakebeds, hillsides and unstable soils. As a result of this, the settlements suffer from flooding and landslides.

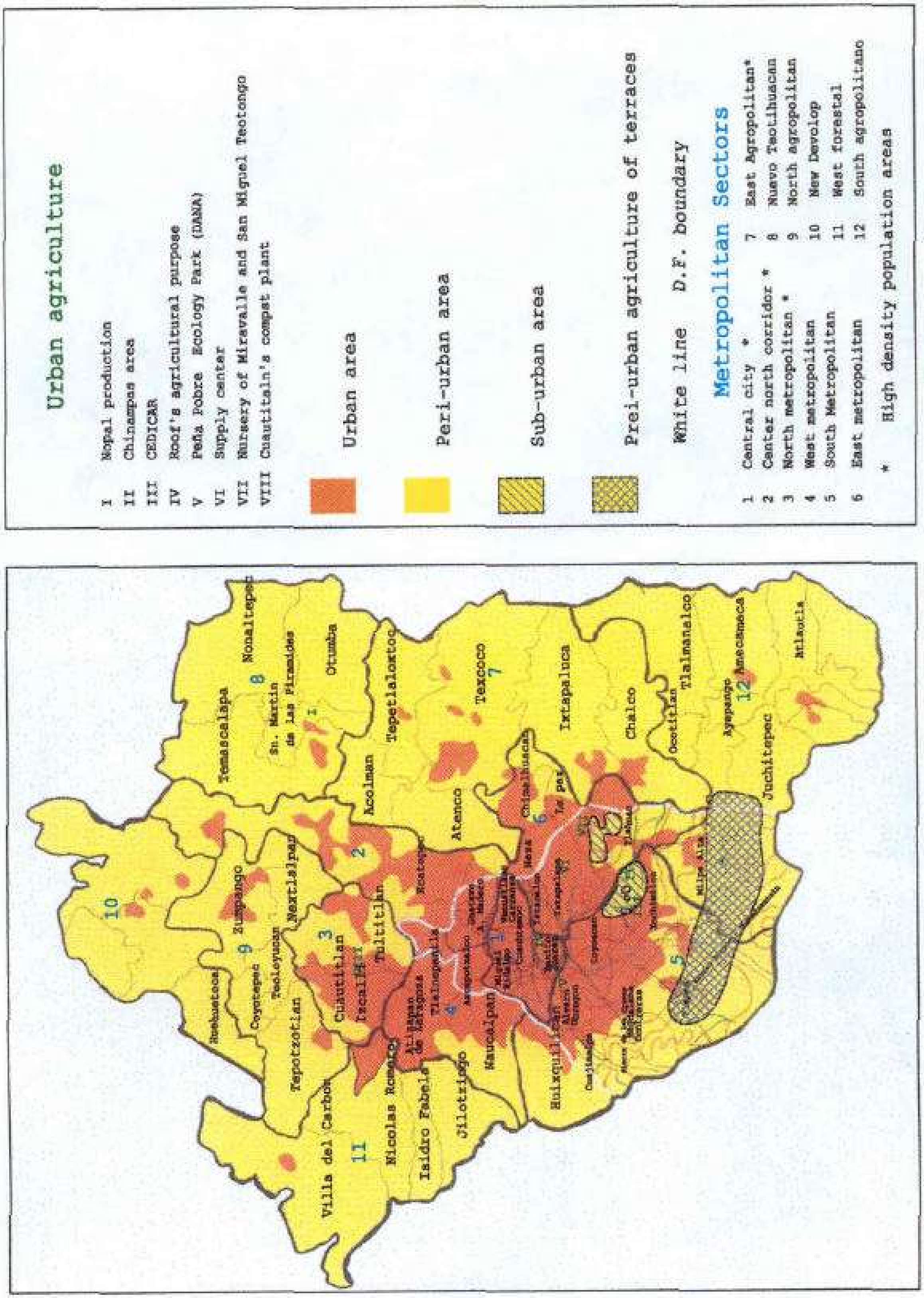
Mexico City, like the rest of the country, experiences great economic inequalities and underdevelopment. Unemployment and the subsequent growth of the informal economy (obvious in the abundance of street-sellers) are problems which increase by the day, generating further and more complicated problems. Buying power has also decreased greatly; by December 1998, the daily minimum wage was 48.00 pesos or approximately US$ 4.

According to the last General Population and Housing Census in 1990, there were 2,884,807 people formally employed within the Federal District (35% of the total population), of which only 19,145 (0.7%) were engaged in agriculture or forestry. This demonstrates the marginality of the sector in the metropolis. In 1991, the primary sector generated only 249,076 million pesos out of a total of 178,423,467 million pesos generated (INEGI 1995).

1.1 Rural land tenure in relation to economic liberalisation and urban expansion

In order to understand the dynamics of the urbanisation process in Mexico City, one has to look at the land-tenure situation and the conceptualisation of land as a commodity. The area of rural land was reduced by continued land expropriations by the government in the last 60 years, which altered the social character of the area. From the 1970s until the beginning of the 1990s, the greater part of the expropriations were to create new space for housing and urban services. This process did not slow down until 1997.

During the last decade, land has been expropriated in order to form nature reserves; however, continued peasant invasions and establishment of shanty settlements within these "protected" areas (often aided by corruption) reduce the size of the green areas as well as the occurrence of agriculture and forestry. When these lands lose their "social character" and take on an urban function, either legally (through expropriation) or illegally (through land invasion), the land becomes a commodity. The urban use increases the value of the land. In the same context, the new reforms to Article 27 of the Constitution directly favour the conversion of *ejidal* (common ownership) land into a commodity.


Urban agriculture
I Nopal production
II Chinampas area
III CEDICAR
IV Roof's agricultural purpose
V Peña Pobre Ecology Park (DANA)
VI Supply center
VII Nursery of Miravalle and San Miguel Teotongo
VIII Cuautitain's compst plant
Urban area
Peri-urban area
Sub-urban area
Prei-urban agriculture of terraces
White line D.F. boundary
Metropolitan Sectors
1 Central city *
2 Center north corridor *
3 North metropolitan *
4 West metropolitan
5 South Metropolitan
6 East metropolitan
7 East Agropolitan*
8 Nuevo Teotihuacan
9 North agropolitan
10 New Develop
11 West forestal
12 South agropolitano
* High density population areas
Villa del Carbon
Nicolas Romero
Isidro Fabela
Jilotzingo
Huehuetoca
Coyotepec
Teoloyucan
Tepotzotlan
Cuautitlan
Izcalli
Naucalpan
Huixquilucan
Zumpango
Nextlalpan
Tultitlan
Tlalnepantla
Ecatepec
Temascalapa
Acolman
Atenco
Texcoco
Tepetlaoxtoc
Otumba
Nonaltepec
Sn. Martin de las Piramides
Chimalhuacan
La paz
Ixtapaluca
Chalco
Tlalmanalco
Amecameca
Ayapango
Juchitepec
Ocuituco

Terraces planted with nopal cactus, maize and vegetables in the periurban area of Mexico City (Picture Luis Manuel Rodrigues)

"Plants for sale". Ornamental plants produced in the Chinampa system. A highly intensive production system in the suburban area of Mexico City (Picture Luis Manuel Rodrigues).

2. Characteristics of urban agricultural activities in Mexico City

Urban agriculture can be defined as all forms of agricultural production that benefit from the infrastructure provided by human concentrations in towns or cities (Ellis & Sumberg 1998). The productive urban agricultural process can be defined by attributes, activities and an identity which are distinct from traditional rural agriculture:

- small agricultural properties predominate;
- animal husbandry uses little area;
- recycled materials are used to construct animal sheds;
- food industry and household wastes are fed to animals;
- cow dung is intensively used as a source of manure, macronutrients (NPK), water and heat;
- the use of local knowledge and technology predominates, and the transfer of local knowledge is by word of mouth;
- products are sold in local markets and/or to neighbours;
- urban and agricultural activities co-exit within family units;
- urban and rural cultures co-exist; and
- production is for both home consumption and sale; urban farming often complements urban subsistence strategies through the generation of income and/or the consumption of self-produced products.

The urban agricultural systems perform a gamut of functions and go beyond simply producing foodstuffs. Typical, for example for backyard animal rearing, is that this is not fixed to the house and that can be moved in the event of external pressures.

Therefore, urban agriculture in Mexico City can be explained only from a perspective that goes beyond analysis of production or economic impact. Agriculture is framed within the context of broader cultural activities where, for example, festivals and celebrations important for community cohesion co-exist alongside natural phenomena and agricultural cycles, as well as technologies and services implicit to city life.

There is also a continuous movement of urban and periurban farmers between the rural and urban environments. For example, the numerous *nopal* (prickly pear cactus) producers in Milpa Alta commute to the city centre daily, to work in typical urban jobs (guards, civil servants, construction workers, etc.). For the rest of the day and in the weekends, they work their *milpa* (cornfield).

Urban agriculture has developed under an apparently "chaotic" informal organisation which, in most cases (such as the cowsheds/stables in the central urban zone) responds to the current cultural and economic conditions, although often violating government regulations and formal institutional arrangements.

Three areas of agricultural and forestry development can be identified: urban, suburban and periurban. They differ in their locality, resident populations and farming systems. Other differences are defined by the density of buildings, the presence of streets, open spaces and other more particular characteristics such as bodies of water and/or forests[1]. These characteristics are identified in Table 1.

Table 1: ***Urban infrastructure and the availability of open space/km^2 (in %)***

Characteristics	**Central urban agriculture**	**Suburban agriculture**	**Periurban agriculture**
Buildings / km^2	83.00	13.00	0.20
Streets / km^2	16.00	1.50	0.20
Open spaces / km^2	1.00	85.00	88.00
Canals / km^2	0.05		
Forest / km^2	2 0.00	0.00	11.60
Agricultural systems	Family gardens: *Community vegetable and medicinal plant production, milk and meat production, backyard pig rearing*	Chinampa: *Legumes, flowers, family orchard, greenhouses and ornamental plants, production of meat and milk, draught animals and small animal husbandry*	Upland agriculture*; Production of* nopal cactus*, family orchards, maize, agrosilvipastoral, forest meat and milk production, draught animals, backyard rearing, beekeeping and sheep rearing*

Source: Losada et al. 1998

The agricultural production systems in central urban zones and their impact are as yet unstudied, little appreciated and of unknown potential. For example, the place of agricultural production in the informal economy is unclear, as well as whether they are restricted to projects by social organisations. Systems in suburban and periurban zones have been studied to a far greater extent and have much more impact and visibility in economic and sociocultural terms.

In general, urban agriculture uses few external inputs. Solid wastes produced in the urban environment are an important source of animal nutrition, with obvious environmental benefits. In the prevailing forms of urban, suburban and periurban agriculture, cow dung – both fresh and dried – serves as a source of organic material, macronutrients, water and heat, and is highly valued. Water and heat are particularly important for producing *nopal* cactus and vegetables in the terraced zone. To a lesser extent, other external inputs are also applied in all production systems. The greatest use of petrol and transport in Mexico City agriculture is for transporting excrement from cowsheds and stables to the field and transporting the products to market. In the Chinampa system, the use of water is intensive, augmenting production costs significantly.

Livestock production in Mexico City consists mainly of backyard animal husbandry. A wide range of animals is reared, including poultry (wild turkey and chickens), sheep, goats, rabbits and – to a lesser extent – cattle and horses. In a few places, people started to produce chincillas. In 1995, 3738 ha were dedicated to raising 16,391 head of cattle, 22,592 pigs, 19,309 sheep and goats, 571,200 chickens and 11,691 turkeys. In the same year, 12,563 litres of milk were produced. As yet, fish farming is not very extensive, being restricted to a few specialised farms, natural parks, agricultural training centres and government lands.

Lactating cows are acquired from rural areas as a way to adapt to the restrictions on land use and breeding; newly bought cows serve to replace unproductive animals (Losada et al. 1996). Swine and poultry are more rarely traded than milking cows.
In animal production systems, vaccines are used to fight cholera in pigs and, to a lesser extent, Newcastle disease in poultry, among others. Frozen semen for artificial insemination, processed animal feeds, mineral salts and vitamin supplements are also used. The use of inputs in suburban and periurban zones is lower in certain respects, because of the availability of open spaces. The existence of specialised state farms has facilitated the introduction of special races of sheep and pigs, and sustained the use of external inputs like vaccines and medicines.

The use of external inputs for crop production in suburban, periurban and rural zones is focused on the purchase of vegetable seed, a selection of flowers, inorganic fertilisers (including *Triple* 17, ammonium sulphate and urea), herbicides, insecticides, growth promoters and greenhouse inputs. In the Federal District, vegetable and flower production is higher than that of grains and fruit (Sagader, 1999). In certain areas of the Chinampas, about three flower yields and five or six radish or purslain yields per year are harvested (Canabal 1997). The output of this production system is considerable, as is the range of crops that is cultivated in the Chinampas.

The production of vegetables, legumes, flowers and *nopal* is labour-intensive within the Chinampa and terrace systems. In cattle-rearing systems, human input is generally lower, although some of the animal production systems do involve higher levels of labour input, such as cowshed-based milk production.

3. Types of urban agriculture: location, practices and analysis

3.1 Agriculture in the central urban zone

The people who practise agriculture in the central urban zone form a mixed group and are of migrant origin. In some cases, people have managed to retain some of their original culture. Frequently, several nuclear families (2-3 family members) live in the same urban plot because of high land-use pressure in this zone (Losada et al. 1996).

In this zone, agriculture – especially vegetable production – is incipient, whereas milk and meat production is more developed, although its irregular character makes it difficult to quantify. Backyard animal husbandry is highly pronounced in immigrant districts, where a small but diverse number of species can be found, including pigs, chickens, turkeys, ducks, geese, pigeons, rabbits and – in some cases – fighting cocks and singing birds. In general, animal breeding has a strong traditional element, which fulfils two principal objectives: to complement the daily family diet or to provide food for festivities. The primary objectives of urban milk production are retail selling at local markets and home consumption. The surpluses are converted into cheese, cream, yoghurt, flans or, if there are no other options, they are used for fattening male calves (Losada et al. 1996).

Pigs, which are bred and fattened in a semi-industrialised way, are sold to the local slaughterhouse. The income is used to buy household necessities. Backyard pig raising is a form of saving for emergencies. Production of rabbit and pigeon meat is drifting towards the tourist areas around the city. Local consumption is limited because of cultural preferences. Fighting cocks are generally reared for sale, or prepared by their keepers in order to fight in local, semi-clandestine rings (Losada et al. 1993).

The producers in the central urban zone have developed skills to recycle products for constructing sheds for their animals and for other uses in agricultural production. The beef and milk production units and the semi-industrialised pig units use conventional building materials and are an exception to this. Most urban chicken coops are built of old construction wood, just as household and industrial wastes are used in other forms of backyard animal husbandry.

Conventional tools used in family orchards include picks, spades, rakes, forks and household utensils – knives, spoons, scissors, machetes, buckets – as well as other tools of pre-hispanic origin: poles and the *coa* (a sort of small scythe).

Within the central urban zone, crop production is rather insignificant. However, a few techniques have been developed that promise to give high yields in confined spaces with limited use of water. For example, production of *nopal* has been initiated in plastic containers and small spaces using compost, manure, small rocks (*tepetate*) and gravel as substrate. To date, yields have been more than satisfactory, giving up to 60 *pencas* (cactus leaves) per square metre, and harvesting can begin after 4-5 months. This technique can be reproduced on rooftops and in urban patios.

3.2 Suburban agriculture

This urban zone has been the focus of migration from those provincial areas closest to the city. A significant part of the population, however, is of local origin – together forming a multicultural population (Friends of Xochimilco 1990, in Soriano 1999). In general, there is one nuclear family living in each house.

Suburban agriculture has three objectives: a) income generation through the marketing of *nopal*, vegetables, *tuna*[2], ornamental plants and meat; b) home consumption of maize, fruit and vegetables; and c) the exchange and/or sale of various products (plant propagation material for family orchards, medicinal and ceremonial plants, spices, etc.) to supplement the family budget.

Animal production is mainly small-scale milk and meat production in sheds and backyards, as well as the rearing of chickens, pigs, rabbits and poultry. Some draught animals are also kept - mainly mules and horses - which are used to transport cow manure to the plots and to transport local weekend tourists.

The organisation of cattle keeping in suburban and periurban areas has a similar logic as in central urban areas. Its importance is a function of the availability of gainful employment in other sectors and general household income; when family members have a job within the city and family income increases, the number of animals kept is reduced and vice versa[3]. Other animal production systems, such as the rearing of sheep for meat, wool and the local sale of milk, have a stronger market orientation.

The seasonal cultivation of maize (which is grown as sole crop or in association with squash, legumes and flowers), beans and oats is predominant in Xochimilco (Canabal 1997). However, flowers (roses, chrysanthemums and marigolds), legumes and vegetables (spinach, chard, various cabbage types, etc.) and herbs are also produced in the Chinampa.

The tools used in the Chinampa zone are of both pre-hispanic (such as the *coa*) and conventional or household (knives and spoons) origin.

The finest example of suburban agriculture is the Chinampa system in Xochimilco District, remnant of the pre-hispanic system that has survived the urban sprawl (Soriano 1999). The Chinampa system covers "islands" surrounded by the waters of the classic Chinampa, around which the population integrates urban concentrations of vegetable and animal production systems. An exception to this is the areas of Chinampa which have been altered and degraded by grazing milking cows and sheep, and a particular type of nursery in urban zones which have caused major changes in the ecosystem by the residues released into the water.

3.3 Periurban agriculture

The people in the periurban areas mainly live in extended families, and have retained strong links to the land and to their social and cultural traditions. In these zones, individual families live on the holdings. Labour tasks can be divided in heavy work for the father and adult sons, while the mother and younger children maintain and manage the backyard and family gardens, and market the produce. Extra labour is frequently hired for tasks that require more manpower, or when a family tries to take advantage of the market.

A particular type of periurban agriculture is found in the south of the city at a higher altitude. The production systems here maintain a spatially rigid distribution, determined by the intensity of the work involved and environmental factors, such as low temperatures. Within these mountainous areas, there are four production zones:

- agriculture within built-up areas, which concentrates on cowshed-based milk and meat production, work animals, backyard animal production and family orchards producing fruits, vegetables, *nopal*, medicinal herbs and ceremonial and ornamental plants;
- the zone next to built-up areas, which focuses on the intensive and largely traditional terraced-based system of producing *nopal*, vegetables and seasonal legumes (beans and *haba*). The *Malvón* flower is frequently grown in

association with *nopal*, cultivated as ornamental plants in city gardens and sold when freshly cut. A full range of tools and implements are employed in terraced *nopal* production. Mule- drawn ploughs are dominant, and the produce is transported from the field to the home by horses. In the valley, tractors are frequently used alone or in combination with mules or oxen for cultivation;

- the area neighbouring the *nopal* production area is considered a zone of transition by some researchers. Maize is produced as a sole crop or intercropped with squash, chili and *haba*, which substitutes for other beans; and
- adjacent to the forest lies a zone of integrated production which produces honey and fodder plants (principally oats) and provides natural pasture; the forest itself produces timber, fuelwood, mushrooms, resins and leaf-mould. Within the forest, an agrosilvipastoral system is applied, which is linked to nearby maize-producing zones, grazing areas and other forests, and ultimately serves to rear sheep and produce fibres.

Agricultural production is limited by environmental factors: scarce and poor-quality water (saline and contaminated by municipal drains), salinisation of low-lying areas, and upland soils not suitable for the traditional form of agriculture. There has been little transfer of technologies appropriate to the needs of farmers and the environment. Low market prices of staple grains and vegetables have not helped to promote production.

4. The contribution of urban agriculture to the household economy

An important aspect of urban farming systems is that they have no minimum or maximum size. The systems are managed on a small to medium scale, and thus enable large sections of the population to benefit. In addition, urban farms use space very efficiently by, for example, combining a house with a cowshed. This is an important aspect, as available land in Mexico City, at 2 m^2 per person, is among the lowest per person in the world. The agricultural systems have found a way to adapt to the conditions of a metropolis.

As a result of the wide diversity in urban agricultural systems, the contribution of urban agriculture to a particular household income also varies. Semi-industrialised and backyard production of swine brings in 10-40% of household earnings, while urban cowshed-based milk production can supply up to 100% of household income (Losada 1996). Backyard aviculture is practised for home consumption and, as such, brings practically no cash income.

In sub- and periurban areas, maize production provides 10-30% of the household income, although the greater part of the grain produced is directly consumed in the family. Vegetable and legume production, on the other hand, accounts for up to 80% of income, and for flower and ornamental plant production the figure is even higher. *Nopal* greens and *tuna* are largely channelled into the Mexico City market, and account for 100% of family income during the summer high season, or when prices are at their highest in winter. In this sense, the quality of life offered by the local authorities to the population with limited economic resources is ameliorated by the urban farmers' own efforts to find ways to improve family consumption or to complement the family's incomes .

4.1 Urban agriculture and employment

Urban agriculture has its greatest impact in the suburban and periurban zones, in which numerous families practice crop production and animal husbandry as a way of life. This is especially true in the areas with the greatest agricultural tradition: Xochimilco, Tláhuac and Milpa Alta. In other areas, periurban agriculture complements other economic activities in which the family engages, such as factory work, jobs in the civil service, and other formal and informal commercial activities like the preparation and sale of food and other services. Most notably, farmers in Xochimilco and the *nopal*-producing Milpa Alta often generate income, which either accounts for total household income or makes a significant contribution to it.

Within the southern parts of the Federal Districts, agriculture still retains considerable economic importance, especially in Xochimilco, Tláhuac, Milpa Alta, Tlalpan and Magdalena Contreras. In Tlalpan and Milpa Alta, for example, agriculture engages 1.3% and 19%, respectively, of the economically active population (XIth General Population and Housing Census 1990).

The Food and Agriculture Organisation (FAO) found in 1988 that the marshy Xochimilco zone generated around 12,000 jobs, proof enough that agricultural production still provides a significant benefit to the families involved. In Tláhuac about 1600 families continue to produce vegetables regardless of flooding and deteriorating water quality (Canabal 1997).

Floriculture, in particular the production of poinsettia and chrysanthemum, from its most rustic form to that of pot-based greenhouse cultivation is an activity of great economic relevance.

Table 2: ***Profitability of flower production***

Crop	Cost of production (US$)	Income (US$)	Profit (%)
Poinsettia	0.8 per plant	1-1.2 per plant	25-50
Malvon	300*	500*	66

* Total production cost (including labour) in a greenhouse.
Source: Calculation on basis of information of San Luis Tlaxialtemalco Xochimilco's Flower Enterprise and Canabal 1997

The impact of agricultural production within a truly urban setting is often more social and educational than economic. Projects of this nature supported by non-governmental organisations (NGOs), such as COCOMI AC, supply vegetables for home consumption to four out of five households during the rainy season, plus around 1,000 pesos per month per farming group to supplement their vermicompost sales, which do not ordinarily meet the groups' needs.

In the case of the CEDICAR programme, the average "container orchard" ensures the supply of 20-30% of the vegetables consumed by a "standard" family of four people. This programme has little significance, however, to the family economy, because the average Mexican's consumption of fresh vegetables is low. Generally speaking, no programme has managed to generate a completely sustainable supply of food.

These programmes of NGOs like CEDICAR AC and COCOMI AC and most of the programmes supported by donor agencies and foreign embassies have not yet proven their ability to stand alone. The majority of the programmes create only one to three jobs. Only programmes developed along more commercial lines generate more jobs. The income the development programmes have been able to generate is not so much from production, but through delivery of courses and the sale of prefabricated latrines, composting bins, worms, vermicompost and educational materials.

On average, according to official occupation figures, urban agriculture does not appear to be significant; and employment in this field has been reduced by 50% in the last 40 years. If farmers in parks and on rooftops do not organise their management and technology and generate economic surpluses, urban agriculture will make only small- to medium-sized contributions to family nutrition, and there will be no basis for true development in this field.

4.2 The marketing of urban agricultural products

Generally speaking, the better part of suburban and periurban agricultural production in the Federal District is destined more for home consumption than for the market. When production exceeds the home-consumption needs (and in the case of those products specifically destined for the market such as flowers, ornamental plants, vegetables, *nopal* and fresh medicinal plants), surpluses are generally sold on local markets or in central urban areas such as La Central de Abastos, La Merced and Jamaica. Only a few exclusive products are exported.

The most important products are sold in the wholesale market (La Central de Abastos). There are also locally important markets for flowers (four in Xochimilco) and for Jamaica in the V. Carranza district. Xochimilco supplied 30% of the Federal District's ornamental plants in 1986 (Canabal 1992).

With respect to sales, the economic importance of *nopal* output from Milpa Alta stands out, as it represents 70% of the total value of production and nearly 100% of *nopal* consumption in the Federal District. In contrast, ornamental plants represent only 3% of total value of agricultural output in the Federal District, yet they account for more than 30% of local supply.

5. Urban agriculture and the environment

Environmental deterioration in the Federal District has its roots in the expansion of the metropolis, and is expressed in four main ways:

- deforestation and forest degradation: annually, 500 ha of forest are lost;
- soil erosion, compaction and extraction: it is estimated that 62% of the southwestern area of the city is in danger of erosion;
- reduced rainwater retention and infiltration as a consequence of urbanisation: the area's aquifer is annually recharged by some 224 million m^3 of precipitation; and
- loss of biodiversity.

The detrimental effects that urban agriculture could have on the environment are minimal in comparison to the impact of industrialisation and urbanisation. In recent times, urban agriculture has functioned as a greenbelt, limiting the outward migration of the urban poor and the spread of urbanisation, and thus ensuring multiple land-use functions. Prime examples of this are Chinampas farming and *nopal* production.

A potential negative impact of urban agriculture within Mexico City's green spaces could be the heavy use of cow dung within the Chinampas and terraced *nopal*-vegetable models of agriculture, as there is a risk of nitrate contamination of the surface and groundwater.

5.1 Urban agriculture and waste recycling

On a daily basis, more than 15,000 tons of rubbish are produced in the city, of which 49.5% is organic and could theoretically be composted.

Three types of waste are used in urban agriculture: that from markets, the food industry (including restaurants) and the home. Wastes that are derived from larger markets (such as La Central de Abastos, which receives and distributes fruit and vegetables for the whole city and covers an area of 300 ha) come from the leaves of the brassica family and maize. Additionally, edibles comprising, e.g. carrots, squash, beetroot and maize, are fed to animals when they become unsuitable to be sold.

In the municipality of Cuautitlán, under a local government initiative, a small-scale project has been developed for the separation and recycling of household wastes. The results have been promising. At present, around two tons of compost are produced each month through aerobic digestion by weekly turning the decomposition beds with an excavator. This project started in 1991; however, only in the last four years has there been constant production. The compost is sold within the region to producers that have orchards.

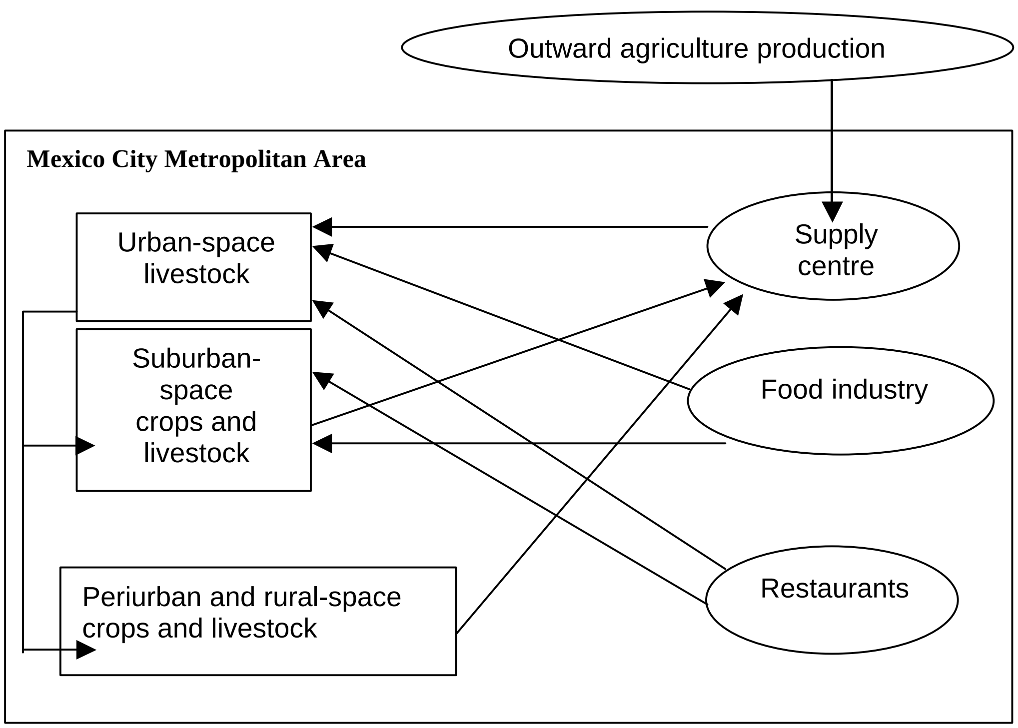
Urban wastes are also used as a source of animal feed. An important aspect is that these are locally-produced residues which, under other circumstances, would contribute to the endemic waste and pollution problems of the city. Huelgas (1997) reports that 100 tonnes of waste are collected daily and fed to 2,500 stall-kept milking cows which, in turn, produce 37,500 litres of milk per day.

Waste, principally derived from tomato, is procured from the wholesale markets and fed to pigs, while in more localised markets throughout the city leaf and vegetable wastes are chiefly fed to rabbits. Solid wastes from the food industry (tortilla producers, maize millers, bakeries, confectioners, etc.) are used as concentrates rich in starch in the milk industry, backyard animal rearing and semi-industrialised pig farms. Pigs are also fed household wastes. Some pasture exists as “banks” that constitute a secondary source of forage for milking cows in urban areas.
The excreta from cowsheds and the semi-industrialised pig farms in different

places around the city form a substantial input for suburban and periurban agriculture, allowing for complex autotrophic systems to function (see Figure 1).

The farmers in Chinampa agriculture and the fixed systems in the valley, use dry manure (20% water content) applied directly to the crop (predominantly maize) or in soil/compost mixes. An alternate use of dry manure is the creation of compost beds in nurseries to produce purslain (Soriano 1998, Losada 1996). According to Soriano (1999), the equivalent of 800 tons of manure per ha per year is applied in the Chinampas and 600 tons per ha per year in the *nopal*-producing zone. Especially important to the terraced-based production systems are the roughly 5 tons of cuttings per ha per year that come from the annual pruning of *nopal* between March and May, and that are directly incorporated into the soil.

Figure 1: ***Mass and energy flows between the different areas of urban agriculture***



The significance of the energy and macronutrient flows does not necessarily rest in the absolute levels of the energy and mineral balance, as the source is biological and renewable, unlike conventional production systems, which rely heavily on non-renewable resources such as fossil fuels. An important cumulative effect of both flows is that in the medium to long term, they build up soils together.

5.2 Urban agriculture and water management

In Mexico City, the potable water distribution network is in a highly deteriorated state: it is estimated that 40% of the potable water is lost through leaks. Cracks in the system result in persistent health threats, such as amoebas entering the water-supply system.

In the metropolitan area, numerous activities do not use water efficiently, e.g. the watering of ornamental plants, car washing and toilets (which on average use more than 20 litres at each flushing). There is minimal re-use of water or capture of home or community rainwater. Water-conservation campaigns have been initiated, but they incorporate only a few programmes, such as fixing leaks and promoting and installing water-efficient and/or dry toilets.

Detergents are commonly used and there does not seem to be any regulation on the horizon. It is common practice for businesses to dump oils, petrol, paint and other chemicals down the drain. Water is considered a vehicle by which wastes can be disposed of, without thought to the consequences. Within this context, urban agriculture as a strategy to manage and take advantage of water, has not been given the attention that it deserves by government, other agencies or environmental groups.

In general, the water used by the city's various cultivators to irrigate their crops is treated or grey. On occasion, the water treatment has not been adequate. It is remarkable that almost no urban farmer systematically collects and uses rainwater.

Table 3: ***Pollutants in Lake Xochimilco entering the agricultural cycle***

Soil	**Water**
Aluminium 7,000 ppm	Iron 144.25 ppm
Mercury 0.90 ppm	Copper 11.67 ppm
Cadmium 0.49 mg/l	Magnesium 3.5 ppm
Nickel 13 ppm	Zinc 104.18 ppm
Chrome 14 ppm	Lead 18.61 ppm
Lead 5.98 mg/l	Chrome 2.77 ppm
Zinc 1.28 mg/l	Cobalt 4.13 ppm
Copper 0.44 mg/l	Nickel 2.88 ppm
Iron 9000 mg/l	Cadmium 0.758 ppm

The problem surrounding agriculture and water resources in the region of Xochimilco encompasses ecological, political, economic and social components. It is a fact that the water is contaminated and that the lack of control regarding water extraction from the city's aquifer, affects the lake, provoking falls in the level in some areas and flooding in others. This is not solely because of lack of information and technology, as some might claim, but more so because of political and economic matters that, under the banner of common well-being, respond to the interests of just a few.

6. Gender aspects of urban agriculture

Women - both as individuals and in groups - play a prominent role in urban agriculture. The socio-economic, political and cultural crisis with which women are confronted in Mexico has forced them to look for options to improve their standard of living. However, despite the fact that women are the principal actors in urban farming in Mexico, one hardly finds examples that intentionally focused on women's realities from the outset. A positive exception is the Social Ecology Promotion Group, which has tried to protect the environment and to improve the living conditions of its members for the last three years. Their projects have principally centred on the collective production of vermicompost and medicinal plants.

The group has been obliged to organise itself, to determine participation regarding work and to take decisions with respect to the generation and distribution of resources and training, etc. The participation of the group's members has, however, been slow and difficult. It is not easy for the women to assume control and take decisions, given their personal formation. They were always taught to conform and be obedient rather than to be creative and take initiative. This is even more the case for women who suffered from both class and gender oppression. Time and again, it has been hard for women to participate in group work and carry out household chores and have a paid job, all at the same time.

All members of the group engage in temporary and informal employment. On occasion, members can go for months without a job and, although the financial help provided by the project is small, it can be important. Over time, they have realised the necessity to undertake activities that not only contribute to the betterment or conservation of the environment, but also generate income which can sustain the group’s work, themselves and their families. On the other hand, a lack of training and overestimation of the leaders retard personal development and group work.

From the foregoing, it becomes clear that any urban agricultural project must take a flexible and open approach to the work, striving to minimise the work input of women, accelerate training and group organisation, and to generate resources for the project and its participants. Only when urban agricultural programmes are able to avoid tripling the workload of women will they become a realistic option for women and their families.

The experience of the Social Ecology Promotion Group demonstrates that a common objective and working opportunities promotes the organisation of women, which –together with a process of education – generates a positive impact. The impact is not only limited to the functioning of the group, but can also transform other aspects of women's' lives, such as those related to work and family.

7. Government policies and urban agriculture

An important limiting factor for suburban and periurban agriculture is the lack of economic incentives. Government policies over the last decade have not protected national agriculture, as the industry has been liberalised, and subsidies have been withdrawn. Moreover, there is no integrated environmental, economic and social policy to enhance agricultural activities.

The decision-making process regarding urban agriculture is centralised: only one institution is responsible for the development of urban agriculture in the city. Within this institution, the tendency is to ignore traditional systems of production and to focus on industrialised, input-intensive systems. This "Green Revolution" type of thinking was exemplified by the construction of a milk and pork production complex that resulted in the loss of all animals. In the case of crop production, the focus has been on the distribution of seed, agrochemicals, agricultural machinery, etc. In the last three years, however, control has been transferred to the municipal and district levels, although the "Green Revolution" thrust has remained.

Agriculture in the central zone is considered illegal. An arbitrary decision divides the city into two exclusive sectors - urban and agricultural - which determine the areas in which agriculture can be practised. As a result, urban expansion goes mainly into areas which were previously occupied by family dairy farms to the southeast of the city.

The government agency, Integrated Family Development (*DIF)*, has promoted backyard family orchards on an intermittent basis through the Urban Orchards Programme. At present, however, this programme has been suspended because of underfunding and limited impact. The programme is now confined to distribution of vegetable seeds.

The goals of government programmes are hardly reached on account of unclear mandates of the different agencies in charge of urban planning and agricultural production, lack of co-ordination and duplication of activities by programmes with identical objectives.

In September 1998, a commission to solve agrarian conflicts such as property and land use was created. One month later, the local congress published the "Federal District Integral Rural Development Law Initiative". Even though this law initiative has not yet been approved, it is significant that the city's government recognises those rural zones still present in the metropolitan area "as a strategic region for the preservation of the environment, and as a guarantee for the fulfilment of the fundamental right of the inhabitants of the Federal District to feed themselves...". It is outstanding that this law mentions the importance of urban agriculture, not only at the periphery of the city but also in backyard gardens and other places, and promotes organic production.

In addition, the city government has organised a series of gatherings and fairs to promote waste-recycling programmes and the reforestation of green and conservation areas. The first rural fair of the Federal District took place recently, gathering a large number of micro-enterprises from the six districts with rural traditions during three days at Xochimilco's Ecological Park. A great number of visitors from different parts of the metropolis visited the fair.

8. Visions and future strategies for urban agriculture in Mexico City

Because of the lack of an institutional or economic order that limits the city's population growth, and because the economic system is incapable of satisfying the economic needs of the population through the industry and services sectors, the evolution of urban agriculture is facilitated by default.

One scenario, and possibly the most likely to occur within the next few years, presumes a passive attitude of the authorities regarding the production problems of Mexico City, which will only prolong the existing situation. The prevalent government perception of agriculture in the city's heart analyses and proposes little, and maintains a marginal status, in terms of social and economic impact. Alternative ideas of academics and NGOs on urban agriculture in the heart of the city have not as yet been put into practice.

Suburban and periurban agriculture can be seen as the remnants of the onward march of the urban against the rural, which has resulted in the loss of the land's agricultural value and traditions. It has brought an increase in consumerism and a dependency on externally-produced goods and foods. The loss of agriculturally productive spaces is increasing in the south of the city, where people live in overcrowded conditions in shantytowns and housing complexes. Urban agriculture can check uncontrolled urban sprawl through the creation of a productive greenbelt around the city, through the organisation of producers and through sound planning. The provision of low-interest loans, the promotion of alternative commercial production packages, the transfer of ecologically-appropriate technologies, culturally-appropriate training programmes, and policies aimed at sustainable urban development could all be elements for an effective urban agriculture policy.

The suburban areas are suffering intense pressure on housing and services, and a decrease in the productive capacity of the soil. Tourism and emerging agricultural activities (such as flower nurseries and tourist corridors) have developed because of the economic gains and, therefore, will co-exist with urbanisation of the area in the long term.

A second scenario starts from the necessity to develop economically-viable options for the periurban zone, especially in tourism and agriculture for a local or regional market. A good example of this is the *nopal* production system in Milpa Alta. Obviously, areas with less demographic pressures will have greater opportunities for developing innovative agricultural activities, integrated with other traditionally urban practices.

The aforementioned greenbelt would have to be well organised and the following conditions should be met:

- producers should be able to count on technology that will allow them to act as a pivot in rural development, which will contain the continuous migration to the city centre;
- the greenbelt should provide habitable and productive spaces, which would facilitate the people to retain much of their original cultural identity; and

- the planning of the greenbelt should respect the agricultural and forest land use of the majority of rural holdings.

However, truly urban agriculture remains marginalised to the areas where NGOs and environmental activists are working, because it is not a strategy of large social urban movements, nor of governments, although their discourse suggests it.

A third scenario suggests that public policy in conjunction with the force of civil society, could generate strategies for sustainable development, whereby agricultural and forestry production play a role in solving the problems of food supply, waste recycling and weak local economies. Doing so would allow the simultaneous development of urban, suburban and periurban agriculture.

Likewise, appropriate economic policies would impede the growth of urbanisation and, at the same time, generate poles of regional development around areas of planned urbanisation, which would respect traditional agricultural areas.

9. Recommendations

It is important to understand that urban agriculture has many dimensions. It cannot be restricted solely to economics, nor to the urban centre. Urban agriculture includes cultural and social dimensions in the suburban and periurban spaces. It generates subsistence and co-existing strategies, and technological innovations. Government policies and university research and NGO programmes should take this perspective.

We found that the development of an agricultural urban economy which both involves subsistence products and is high-yielding guarantees families part of their food supply and marketable production at the same time. Such an economy should promote fair-trade networks under conventional schemes, but also allow the exchange of produce and services through bartering. It is essential that government supports this kind of project, making available the resources necessary to start the creation of micro-enterprises.

Urban agriculture should look towards strategies that promote a sustainable market-oriented agriculture (e.g. *nopal* and ornamental plant production), reducing the ecological impact of fertilisers and pesticides. Schools, civil groups and local government should promote children's awareness of domestic food production[4].

In production for home consumption as well as commercial or mixed purposes, ecological agriculture should be promoted. From an ecological perspective, the development of urban agriculture entails a profound transformation of the existing economic model, as well as a radical change in the strategies and policies for urban development. For this, material and energy scarcities also need to be take into account. Following this perspective, the management of water and waste in the Mexican Valley should be completely modified. Nevertheless, even if economic and cultural changes are necessary, the sustainability of the city depends more on democratisation, governability and citizens' participation in the planning and management of local and regional urban development and citizens' security.

This necessarily implies decentralising political and economic power within the city.

A key question is whether the State is willing to start this process.

To start such a process we would like to suggest some concrete proposals related to urban agriculture for sustainable development in Mexico City:

- the application of ecological techniques in housing, to improve the quality of life of the citizens and to allow a more rational and integrated use of resources;
- the generation of urban-domestic production units (e.g. vegetables, flowers, mushrooms and medicinal plant production, small-animal rearing and productive waste management) and micro-enterprises to generate income and jobs. The micro-enterprises should operate at collective, individual and family levels and produce specialist products;
- the use of recycling as a way to save energy and material;
- the growth of local economies through the integration of different local businesses into larger, more regional business. This would allow the generation of sufficiently large volumes to compete in large markets, and likewise the acquisition of technologies, services and materials in bulk at lower costs;
- efficient and "snug" family orchards to secure home consumption of those horticultural products, which are in greatest demand in the central urban zone.

This would allow the creation of a barter network of vegetable interchange between the differing households and a certain degree of specialisation within individual holdings and, at the same time, maintain a variety of choice at the local level;

- the use of alternative central urban spaces, like large rooftops, patios, abandoned and other periferal areas, in order to establish local enterprise units of a somewhat larger size, such as regional integrated enterprises; and
- to appreciate urban agriculture in the central zone, in environmental, cultural and economic terms, its activities should not be restricted, but its proper environmental management and regulation should be strengthened.

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1 These characteristics were defined according to the distribution of soil type within Mexico City's metropolitan area (García 1992).

2 Fruit of the *nopal* cactus.

3 This is called the Agriculture and Ranching Social Relationship Index (ARSRI). A factor contributing to the flexibility of this ARSRI is the presence of backyard animals in family-based production systems, and its relation to religious, social and cultural festivals, expressed in the preparation of local culinary dishes.

4 First-generation low-income migrants in Mexico City may develop small orchards to produce maize, squash or fruit trees in their homegardens, but their children and childrens' children, who have no cultural link with the land, generally lose interest in food production.

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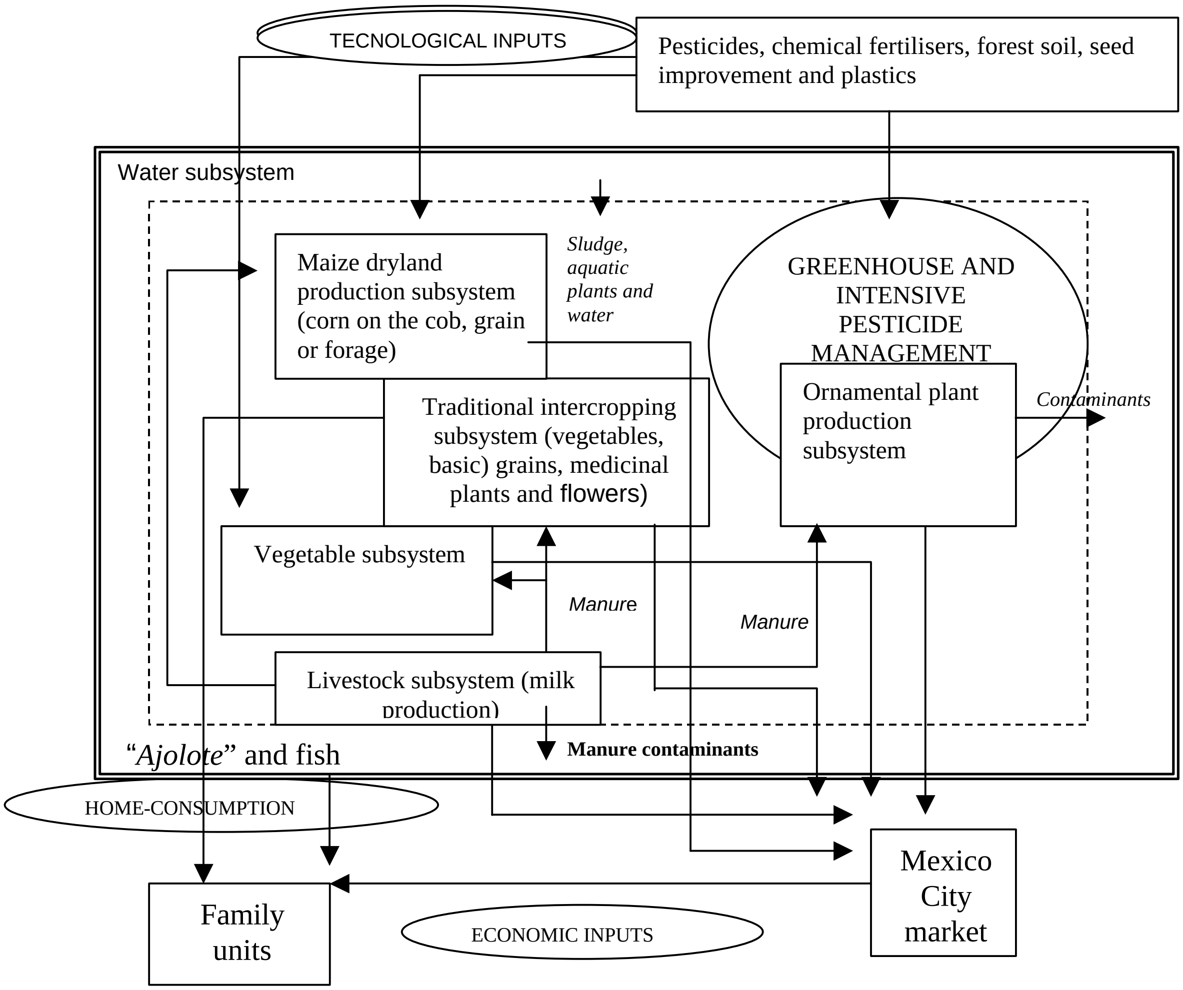
Appendix 1: *The Chinampa production system*



INCREASING FOOD SECURITY THROUGH URBAN FARMING IN NAIROBI

Dick Foeken and Alice Mboganie Mwangi

1. Introduction

As any visitor to Kenya's capital can see, farming activities are everywhere, not only in the outskirts but also in the heart of the city. Along roadsides, in the middle of roundabouts, along and between railway lines, in parks, along rivers, under power lines, in short, in all kinds of open public spaces, crops are cultivated and animals like cattle, goats and sheep roam around. What most visitors do not see is that there is even more farming, notably in backyards in the residential areas. People of all socio-economic classes grow food whenever and wherever possible. This paper is based on the four studies that have been carried out thus far on urban farming in Nairobi.[1] By "urban farming", we mean any farming activity within the city boundaries[2], including the cultivation of food and cash crops, animal husbandry, forestry and the production of flowers and garden plants.

Nairobi is located at the southern end of Kenya's Central Highlands and lies at an altitude of between 1600 and 1800 metres above sea level (Ng'ang'a 1992). Mean annual temperature is 17^{o}C, while the mean daily maximum and minimum are 23^{o}C and 12^{o}C, respectively (Situma 1992). Mean annual rainfall ranges from about 800 to about 1,050 mm, depending on altitude (Ng'ang'a 1992). Most of it falls in two distinct seasons: the long rains from mid-March to June and the short rains from mid-October to early December.

The present population of Kenya is estimated to be about 30 million. The average population growth between 1980 and 1993 was 3.3%. Due to the large influx of people from the rural areas, the population of Nairobi grew much faster, from half a million in 1969 (Kenya 1971) to an estimated 2 million in 1998 (Kenya 1996a). Most of the migrants end up in one of the low-income areas of the city. Almost half (47%) of Nairobi's population live in very-low-income neighbourhoods (Jones et al. 1995). Population densities can reach values of more than 30,000 persons/km^2. One of the highest densities is found in Korogocho Sub-Location, where in 1989 more than 44,000 people were packed together in an area of about one km^2 (Kenya 1994). Such "informal" or "uncontrolled" residential areas, as they are usually called, can be found as "pockets" all over the city (Syagga & Kiamba 1992).

Table 1: ***Kenya and Nairobi: some basic statistics***

	Kenya	**Nairobi**
Area (km^2)	580,000	693
Population* (million) 1989	21.4	1.3
Population (million) 1998	30.0	2.0
Growth rate 1980-1993 (%)	3.3	5.1

* 1989 figures from latest Population Census; 1998 figures are estimations
Sources: Kenya 1994, 1996a.

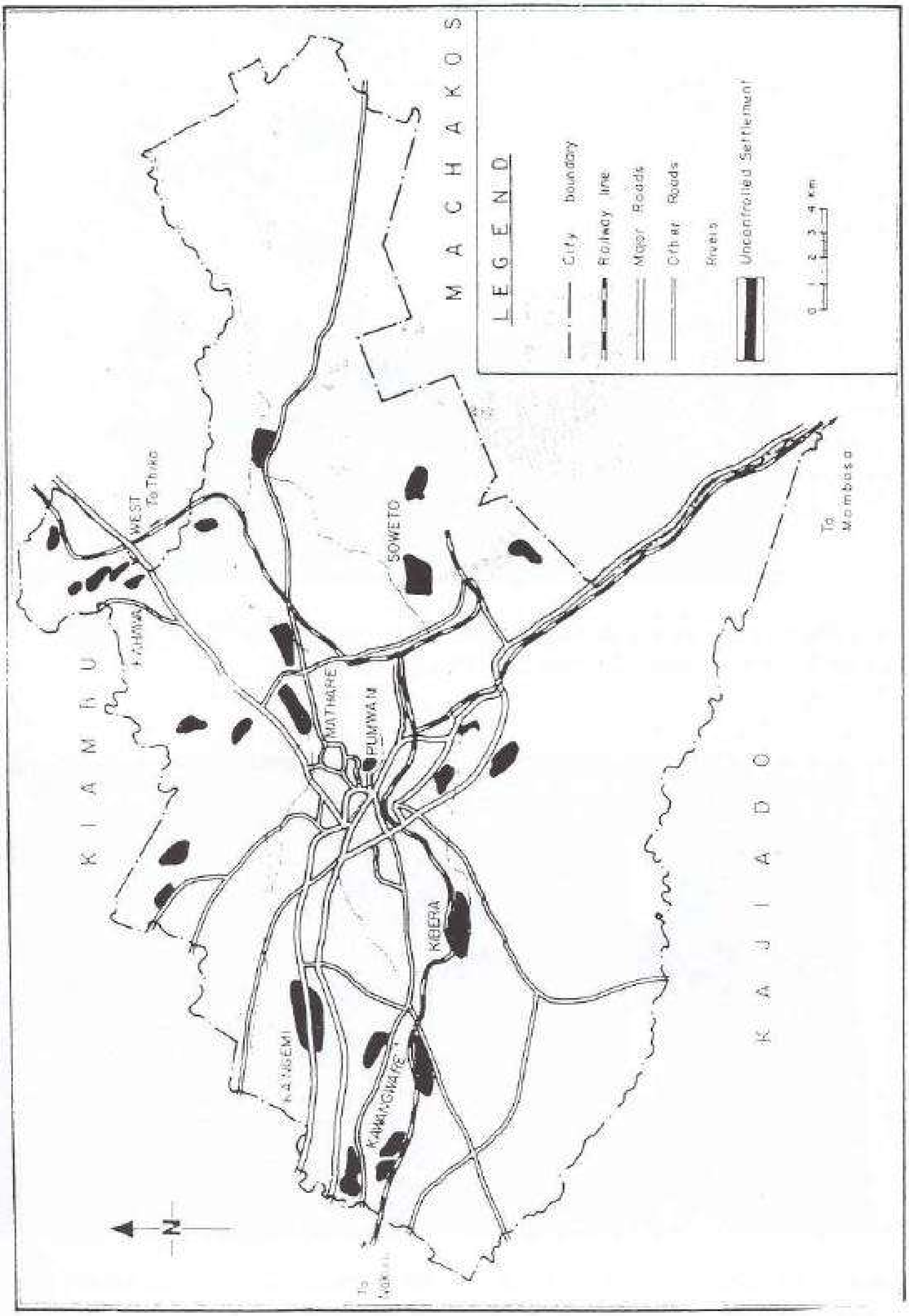
Urban poverty in the mid-1970s was negligible: only 2.9% of the households in Nairobi were living below the poverty line (Collier & Lal 1986). In the 1980s and 1990s, the situation changed drastically, on account of three interrelated circumstances:

- rapid population growth as a result of both high natural increase and accelerated rural-urban migration (Nairobi's population grew at a rate of 5.1% during the 1980s);
- the on-going economic recession: economic growth declined steeply since 1980 (dropping from an average of 5% during 1978-81 to only 2.2% in 1990-91); and
- the impact of structural adjustment policies, e.g. a reduction of government spending, increased taxation, currency devaluation, increasing real producer prices for agriculture.

All of this has made life far more expensive for the Kenyans, and for the poor in particular. The result is that vulnerable groups like the urban poor are increasingly marginalised (KCO 1992).

The studies that have been done (Kenya 1983, Kenya 1989, Ondiege & Syagga 1990; KCO 1992) mention the various ways by which the urban poor try to make ends meet. Most poor people have no regular job and rely on casual work. Informal, micro-scale business activities are very common (including begging, theft, illegal brewing and prostitution). Some figures point this out quite dramatically. Between 1989 and 1997, the Nairobi population grew by an estimated 51%, while wage employment in the formal sector grew by only 15% (Kenya 1996b, 1998). In the 1994-97 period, wage employment in the formal sector grew by 5%, but the number of persons engaged in the informal sector increased by 65% (Kenya 1998). Nowadays, about two-thirds of the Nairobi working population depend on the informal sector for their livelihood (Kenya 1998).

In many respects, Nairobi is not representative of urban Kenya. Being the national capital and being so much larger than any other urban centre in the country, Nairobi dominates in terms of economic, political and cultural



K I A M B U
M A C H A K O S
K A J I A D O
LEGEND
City Boundary
Railway line
Major Roads
Other Roads
Rivers
Uncontrolled Settlement
0 1 2 3 4 km
To Thika
To Mombasa
MATHARE
PUMWANI
SOWETO
KIBERA
KANGEMI
KAWANGWARE
N

Between the railway tracks near Nairobi station; crop cultivation (mainly maize) is very common (Picture Dick Foeken)

Small scale subsistence crop of spinach and sukuma wiki in a roundabout near Kibera, south-west Nairobi (Picture Dick Foeken) aspects. As a result, the city attracts a continuously large flow of migrants from all parts of the country. On the other hand, since this paper deals with urban agriculture, it should be noted that, in this respect, Nairobi is *not* very different from other urban centres in Kenya.

This became clear from the results of the survey carried out by the Mazingira Institute in 1984/85, which covered, besides Nairobi, also (in sequence of size) Mombasa, Kisumu, Kakamega, Isiolo and Kitui.

2. Urban farming in Nairobi

In the mid-1980s, 20% of Nairobi households were growing crops within the city limits (Lee-Smith et al. 1987). Moreover, 7% appeared to keep livestock in town. Although households in all socio-economic classes do urban farming, poor(er) households are over-represented. This was confirmed by the study in the slum area of Korogocho carried out in 1994: 30% of the households could be classified as urban farmers (Mwangi & Foeken 1996). Based on these findings, it seems fair to estimate the number of households in Nairobi involved in urban farming in the late 1990s in the order of at least 150,000.[3]

Table 2 shows several characteristics of the plots used for urban farming. There are substantial differences concerning the location of plots as recorded during the various surveys.[4] Although at least one-third of the plots are privately owned, i.e., usually in backyards, the people in the low-income areas can obtain a *shamba* (Swahili for plot) only on public land (roadsides, riversides) or privately-owned land belonging to somebody else (along railroads, in estates, industrial land). None of the selected farming households in Korogocho and Pumwani/Eastleigh owned a piece of land, simply because housing conditions are so crowded that not even the smallest backyard is available.

Plot sizes vary considerably, both in terms of the means found in the various surveys as well as the range of sizes in each survey. Again, this can be attributed partly to sampling methods: the very small average size of 99 m^2 found by Lee-Smith et al. in 1985 is undoubtedly related to the high percentage of backyard farming. In the three other surveys, plots were much larger, particularly in the very-low-income area of Korogocho. Since the latter area is very densely populated, most plots are located outside the built-up area in empty spaces owned by the municipality. As a result, distances between the farmers' homes and their *shambas* are quite large. This is not only time-consuming but also a disadvantage in terms of theft of crops.

Table 2: ***Plot characteristics***

Year of survey	**1985**[a]	**1987**[b]	**1994**[c]	**1994**[c]
Area	Nairobi	Nairobi	Korogocho	Pumwani/E.
N	154	618	48	62
Location of plots (%):				
Private residential		71	32	-
Roadside	10	29	31	7
Riverside	9	16	43	86
Plot ownership (%):				
Self/family	33	24	-	-
Private landlord	9	29	24	7
Public land	51	45	74	93
Size of plots:				
Average (m^2)	99		3200	1400
% >=200 m^2	-	76	80	50
% >= 1000 m^2		47	73	29
Number of plots:				
% hh's with 2 or more plots	12	30	31	38
Distance to plots (%):				
<1 km		74		
<10 min. walking	-	-	3	68
> 30 min. walking	83	6		

Sources: a) Lee-Smith et al. 1987; b) Freeman 1991; c) Mwangi 1995.

Quite a number of farmers have access to more than one plot. Access to multiple plots has several advantages for the farmer. Different ecological qualities of the plots make it possible to widen the range of crops. Moreover, plots separated from each other by considerable distances, as is often the case (Freeman 1991), reduce the risks of losses from theft, pestilence or destruction by the rightful owners of the land.

3. Farming practices

Roughly, four farming systems can be distinguished in Nairobi. The first one, small-scale subsistence crop cultivation, is by far the dominant type. The second type concerns small-scale livestock production, often combined with the first type. Only a few words will be spent on the third type, namely small-scale market-oriented crop production. Finally, in the south-western part of the city (Karen, Langata), some large-scale commercial farming remains from the colonial period, characterised by irrigated vegetable fields, battery hen houses and grade dairy cattle. As we have no data on this activity, this type is left out of the discussion.

3.1 Small-scale subsistence crop cultivation

The Nairobi farmers cultivate a wide range of crops (see Appendix 1). The most commonly produced crops are listed in Table 3. Farmers always plant a variety of crops on their *shambas*. Conspicuously absent are tree crops, for reasons of limited space (many plots are too small) and uncertainty regarding land tenure. The table shows that the basic staples such as maize, beans and *sukuma wiki*[5] particularly stand out as the crops cultivated by the large majority of the farmers. In terms of frequency of plantings and overall area, maize is the prevalent crop (Freeman 1991). Under ideal conditions, maize may yield as much as 1200 kg per ha; however, Freeman estimated the average yield at 200 kg in a good season. As in the rural areas, maize is usually intercropped with beans, which is the crop second in importance in Nairobi.

Table 3: ***Main crops produced by the Nairobi farmers***[6]

Area	**Nairobi** [a]	**Korogocho** [b]	**Pumwani / E** [b]
N:	154	48	62
sukuma wiki	63	35	73
tomatoes	a?	23	31
beans	38	71	73
cow peas	12	33	24
maize	35	71	97
Irish potatoes	14	23	26
sweet potatoes	1	17	29
arrowroot	1	21	26
bananas	2	17	47

a) Included in “other vegetables” (31%); see Appendix 1.
Sources: a) Lee-Smith et al. 1987; b) Mwangi 1995.

The labour is provided mainly by women. For instance, in 80-85% of the farming households in Korogocho and Pumwani/Eastleigh, the women were responsible for the farming activities (Mwangi 1995). Cultivation practices are usually very simple: the *panga* (sturdy bush knife) and *jembe* (hoe) are about the only tools used. The use of “modern inputs” is quite limited. Maintaining or improving soil fertility is mainly done by means of animal droppings or organic material. Chemical inputs are used only by a small minority of farmers, because most farmers cannot afford them.

Table 4: ***Inputs used in crop production (% of households)***

Year of survey	**1985**[a]	**1987**[b]	**1994**[c]	**1994**[c]
Area	Nairobi	Nairobi	Korogocho	Pumwani/E.
Manure	29	31	49	49
Guano (poultry droppings)		15		
Crop residues/urban waste			51	59
Compost	35			
Mulch	23			
Chemical fertiliser	19	31	29	2
Seedlings	87			
Improved seeds/seedlings			51	30
Natural pesticides		1	32	55
Chemical pesticides	11	13	17	25
Fungicides	8	13		

Sources: a) Lee-Smith et al. 1987; b) Freeman 1987; c) Mwangi 1995.

Except for those who use their backyard for farming purposes, irrigation is quite rare. Freeman (1991) came across one out of eight cultivators practising some kind of irrigation. For many of the poorer farmers, only those who have plots along a river can benefit from the yearly flooding of the river bringing water and nutrients into the soil (as well as minerals that are also harmful for human consumption). Irrigation with sewage water is not uncommon in Kibera, as almost 25% of the farmers use it (Dennery 1995).

3.2 Small-scale livestock production

Livestock is a quite common sight, especially in the open spaces in the outskirts of the city. Freeman (1991) found that over half of "his" urban farmers kept some animals. Poultry is by far the most common species, followed by goats, cattle, sheep, rabbits and pigs (Lee-Smith et al. 1987). Lee-Smith and Memon (1994) estimated the number of cattle in Nairobi at 23,000 head. In the very-low-income area of Korogocho, where over 15,000 households are living (Kenya 1994), we estimate the number of cattle to be about 1,000, sheep 1,250, goats 2,300, chickens 4,000, rabbits 2,000 and ducks 400. If space was available, many more people would like to keep livestock. Little information is available regarding inputs used for livestock rearing. Practices like dipping, spraying, vaccinating and using veterinary drugs are not very common. This partly explains the high mortality rate among the Nairobi livestock. Most farmers give additional feeding to their animals, such as crop residues and/or urban waste.

3.3 Small-scale market-oriented crop cultivation

Despite its potential in terms of food, employment and income, small-scale crop production entirely for commercial purposes is a rare phenomenon in Nairobi and we know of only a few examples. The first example concerns ornamental crops, grown in plastic bags. It is commonly more well-to-do people who engage in this activity, and who have employees to run the plot. The plants are mainly seedlings sold to individuals and landscaping companies. The second case also concerns seedlings, notably of vegetables, grown on very small plots. An example is the Mathare Self-Help Group, consisting of jobless slum dwellers. The group succeeded in obtaining permission from the City Council to till land next to the road in Kariokor. The seedlings are sold to farmers as far as the rural areas of Kiambu. Finally, Freeman (1991) mentions a very special crop, notably, “natural hay”. He noticed that Kikuyu women scythed the lush grass on roadside verges with their *pangas*, to be collected by dealers for selling on the market as animal fodder. Although not a cultivated crop in the strict sense, Freeman considers the crop to be "a product of the city's open spaces with evident commercial value".

3.4 Agricultural advice

Almost all Nairobi farmers are completely left on their own, getting no assistance or advice of any sort. However, the Ministry of Agriculture does provide extension services in Nairobi, in principle to everyone who asks for it. Yet, roadside, riverside and sewage-line farming are not recognised by the officers, as these activities have been prohibited according to the 1961 Nairobi City Council bylaws, which since then have never been reviewed (Ateka 1999). This implies that many of the poor urban cultivators do not qualify for extension.

4. Characteristics of the Nairobi farmers

The majority of the urban farmers in Nairobi are women. Particularly among the low-income farmers, the percentage of female-headed households is relatively high. For many poor women who lack the presence of an adult man in the house and who have children to feed, farming is something of a last resort. This has also to do with their relatively low level of education in comparison with the men, as all studies revealed. Nevertheless, it is surprising that almost one-quarter of the heads of the low-income farming households in both Korogocho and Pumwani/Eastleigh had completed secondary school education. Apparently, lack of employment opportunities has forced these people into agriculture.

Table 5: ***Demographic characteristics of the Nairobi farmers***

Year of survey	**1985**[a]	**1987** [b]	**1994** [c]	**1994** [c]
Area	Nairobi	Nairobi	Korogocho	Pumwani/E.
N	154	618	48	62
Gender:				
% female cultivators	62	64	80-85	80-85
% female-headed households	11		35	39
Household size:				
average No. of persons	5.4		6.9	6.8
Age of household head:				
% <40 years of age		52	62	40
Education of hh head				
% no formal education	7	29	17	34
% at least primary school		43	69	48
% secondary school			23	21
Migration of hh head:				
% born outside Nairobi		87	90	73
% >14 years in Nairobi		58	63	85
Ethnicity of hh head:				
Kikuyu		ca 50*	48	90
Luo		6	33	
Kamba		ca 15*	15	8

* Own estimations, based on figures in Freeman 1991: 57-59.
Sources: a) Lee-Smith et al. 1987; b) Freeman 1987; c) Mwangi 1995.

Most people engaged in urban farming have been living in Nairobi for quite a long time. This rejects the view which was popular until recently that urban farmers are new migrants from rural areas simply continuing their original way of living in an urban environment before getting adapted to the urban way of life. New migrants do not come to the city to practise agriculture but rather to look for formal employment. Not succeeding in this, many of them try to get access to a piece of land in order to grow food. However, one has to be firmly settled in the city in order to be able to obtain a plot, “settled” meaning that one has to have the right personal (i.e., ethnic) network through which land can be acquired.

Relatively few people in the farming households in Nairobi are employed in the formal sector. Many are either unemployed or perform some casual labour. In the slum areas of Korogocho and Pumwani/Eastleigh, informal trade and food selling were the most frequently mentioned sources of income. Among the non-farming households in Korogocho, illegal trade and practices (like manufacturing and selling alcoholic brews, prostitution, street begging and stealing) scored high (24%) in comparison with the farmers' group (10%).

This might be an indication that lack of access to agricultural land pushes these destitute people into illegal activities.

Table 6: ***Socio-economic characteristics of the Nairobi farmers***

Year of survey	**1987** [a]	**1994** [b]	**1994** [b]
Area	Nairobi	Korogocho	Pumwani/E.
N	618	48	62
Respondents	Cultivators	All adults	All adults
Employment (%):*			
employed in formal sector	22	15	24
casual labourer	58	19	
unemployed	47		
Household cash income (%):			
very low income**	43	33	44
low income**	35	25	16
% of household income spent on food:			
50%	49	56	77
70%	37		
75%		35	36

* In both Lee-Smith et al. (1987) and Lee-Smith et al. (1988), employment figures are presented for the whole sample, but not for the sub-sample of farming households.
** The figures from Freeman and Mwangi are not easily comparable, because of the different years of the surveys and different cut-off points. Freeman (1991: 62, 145) defined as “very low” an annual household cash income of less than KSh 10,000 and as “low” KSh 10,000-20,000. The cut-off points for the Korogocho and Pumwani/Eastleigh surveys were KSh 12,000 and KSh 24,000.
Sources: a) Freeman 1991; b) Mwangi 1995.

The data on household incomes in the different studies cannot be easily compared, because the surveys were made in different years and had different cut-off points for the income classes. Nevertheless, the available data make it clear that most Nairobi farmers belong to the group with low to very low incomes. Generally, the farmers' households spend a very large part of their income on food; over one-third of them spend even 70 -75% of their income. This percentage would be even higher if these households were cut off from their farming activities, or otherwise they might starve from hunger.

5. The importance of urban farming

Lee-Smith et al. (1988) calculated the total annual crop production in the urban areas in the mid-1980s to be about 5.2 million kg. Three-quarters of this was consumed by the producers, while the rest was sold. Relatively few animals were marketed, thus adding very little to the meat supply of the city. Most animals were kept to produce manure and as a savings account for emergencies.

Table 7[7]: *Livestock in Nairobi, total numbers, self consumed and sold, by type (1985)*

Type	**Total number**	**No. consumed by producer**	**No. sold (1984)**
Cattle	25,000	-	-
Goats	34,000	4,750	1,700
Sheep	19,000	1,150	8,000
Pigs	9,500	-	-
Poultry	260,000	65,000	5,200
Rabbits	43,500	11,750	1,750

Sources: Own estimations based on Lee-Smith et al. 1988: 37-38; Kenya 1981: 29; Kenya 1994: 1-3.

Farming is done primarily to improve the households' food situation. Not only the absolute amount of food, but also the dietary composition is often mentioned as a reason to practise urban farming. This explains the popularity of a crop like *sukuma wiki*. However, also others, i.e., non-farmers, can benefit from it. Farmers sell some of the vegetables often at a somewhat lower price than in the official markets.

In Korogocho, food energy intake among the group of urban farmers was somewhat higher than among the non-farmers, thanks to the Korogocho farmers' own production.[8] The same applies to the intake of proteins. In addition, the Korogocho farmers seemed to be better off in terms of material ownership, even though their monetary income was about the same. In other words, for the Korogocho farmers, urban agriculture appears to be beneficial in two ways: directly because of a greater energy and protein intake and indirectly because it enables them to spend less money on the purchase of food ("fungible income"). The higher energy intake among the Korogocho farmers was, to some extent, also translated into a better nutritional condition of the children: in terms of percentages, fewer children of farmers were wasted, stunted or "severely malnourished" than those of non-farmers (Mwangi, 1995).

Despite the subsistence character of farming in Nairobi, the importance as a source of income should not be underestimated. Selling is, in fact, quite common, also among the "subsistence" crop cultivators. However, it usually concerns small quantities. Nevertheless, sales are important to meet other basic needs, such as maize flour, paraffin, school fees, etc. Also, those who keep livestock for subsistence sell some animals, though usually at a very marginal scale.

Most labour on the *shambas* consists of unpaid family labour. However, the small-scale market-oriented cropping sector offers some potential for employment. Most people cultivating and selling ornamental crops are employed by the owners of these businesses. However, the number of these enterprises is quite limited, so one can conclude that, in general, urban agriculture as a source of employment for people other than the actual farmers is (still) negligible.

6. Constraints faced by urban farmers

The Nairobi cultivators face multiple problems (Appendix 2 lists all the problems that were mentioned by the respondents in Korogocho and Pumwani/Eastleigh). Conspicuous are the high percentages of respondents in 1985 and 1987 who stated that they faced no problems. It is likely that this concerns either people who cultivate in their backyard or commercial farmers on the outskirts of Nairobi. Some of the problems mentioned by the cultivators are not specific to the urban circumstances and are the same as any rural farmer can face. In Table 8, these problems are brought together under the heading of “natural problems”. Undoubtedly, the most important urban-specific problem is the theft of crops. Almost all farmers in Korogocho and Pumwani/Eastleigh mentioned this as a serious problem and, for the majority of them, it was the major problem. Popular crops with thieves are, amongst others, bananas, cocoyams and maize, as these have a ready market and are difficult to camouflage (Freeman 1993). Women are not only more prone to lose part of their crops than men; they also tend to lose larger quantities, as men are more likely and better able to guard their crops personally (*ibid.*). Although never mentioned as a (major) problem, theft of livestock also occurs.

Table 8: ***Constraints faced by the Nairobi farmers regarding crop cultivation (% of households)***

Year of survey	**1985 [a]**	**1987 [b]**	**1994 [c]**	**1994 [c]**
Area	Nairobi	Nairobi	Korogocho	Pumwani/E.
No. of housholds surveyed	154	618	48	62
Type of question	Most serious problem	First-mentioned problem*	Major problem	Major problem
No problems	22	29	-	-
Natural problems:				
drought/lack of rain	-	16	4	-
flooding/waterlogging	-	7	-	2
poor soil	17	6	-	-
destruction by animals	24	-	-	-
pests/diseases	-	10	17	2
"Urban" problems:				
theft of crops	13	7	56	75
lack of inputs/capital	14	4	17	8
plot used as toilet	-	-	-	13
threat of eviction/destruction	-	4	-	-
Other problems	10	17	6	-
Total	100	100	100	100

*) Freeman presents the "first-mentioned" problem, assuming "that a farmer would normally mention the most pressing or important problem first". The results of the 1994 surveys indicate that this is a wrong assumption. It follows that Freeman's figures may not be entirely comparable with the figures from the other surveys.
Sources: a) Lee-Smith et al. 1987; b) Freeman 1987; c) Mwangi 1995.

Since the majority of the farmers in Nairobi are poor to very poor, many of them have no financial means to purchase inputs (see Appendix 2). Investing in maize production is discouraged because of the risk of theft, thus forcing the crop to be harvested when it is still green and much less rewarding both financially and nutritionally than dry maize.

Many farmers in Pumwani/Eastleigh faced a very specific problem, namely the use of their plots as toilets (see Appendix 2). Remarkably few farmers mentioned harassment, eviction or destruction of crops by the local authorities as a (major) problem. This is related to the question of land tenure. Uncertainty regarding the land used by cultivators was also hardly mentioned as *the* major problem. This is the more surprising as most farmers cultivate land that belongs to somebody else, hence continuously facing the risk of being evicted by the rightful owner.

7. Urban farming and the urban environment

Very little is known about the environmental impact of farming in Nairobi. Most farming consists of subsistence crop cultivation by the poor, who usually have no money to buy chemical inputs. Hence, it is not very likely that chemical pollution due to urban farming constitutes a major concern (although on the large-scale farms on the fringe of the city, chemical inputs are undoubtedly widely used).

Soil erosion does take place in Kibera and the farmers practised various ways to keep the process under control (Dennery 1995), e.g. digging drainage ditches against gully erosion. Sheet erosion was combated with crop residues, at the same time enhancing moisture retention. In Pumwani/Eastleigh, bananas and Napier grass were planted in order to control flooding of the Nairobi River. The rivers flowing through Nairobi are heavily polluted by industrial effluent and human waste. Plots located along these rivers are flooded each year during the rainy season. Although this may be advantageous for maintaining soil fertility, crops can become seriously contaminated and can affect human beings (and animals, in the case of fodder such as Napier grass). In some areas, untreated sewage water is being used for irrigation. Dennery (1995) estimated that about one-quarter of the Kibera cultivators use sewage water.

Nairobi's solid waste is collectively dumped at Dandora (commonly known as Mukuru). The waste is never separated, which poses a number of environmental and health hazards. A group known as Mukuru Self-Help Group scavenges the dumping site for organic waste in order to make fertiliser, which is partly sold and partly used for their own vegetable production project near Dandora Catholic Church. A few garbage collectors from the city deliver some of the waste, already separated, to this group. Although the group is playing a positive role in waste recycling, the impact is no more than “a drop in the ocean”.

Lee-Smith et al. (1988) found that three out of ten urban cultivators use manure to increase the soil fertility on their *shambas*. Almost 90% of these cultivators obtained it either from their own livestock or from other livestock keepers. Thus, there does exist some kind of recycling of organic material. In the very-low-income areas of Korogocho and Pumwani/Eastleigh, the use of manure in the mid-1990s was even higher (50%).

8. Policy aspects

Open-space planning in the city is administered by zoning regulations dating from the colonial period. Through the years, zoning regulations have changed somewhat, particularly regarding informal sector activities. With written permission – a so-called Temporary Occupation Licence or TOL (Munari 1994; Karanja 1994) – livestock may graze on the outskirts of the city. The regulations regarding crop cultivation, however, have not changed and this is still strictly forbidden (the farms that came to be located within the city boundaries after the city expansion in 1964 are, of course, not illegal). The present policy, however, is one of ignoring the activity. The reason for tolerating it most likely has to do with the sheer magnitude of the phenomenon.

There has been only one effort to develop urban agriculture in Nairobi (Gathuru 1988; 1993a). It is part of a wider project on slum development organised by the Undugu Society of Kenya for "underprivileged" people living in the low-income area of Pumwani/Eastleigh. The Society obtained official permission from the City Council to use the land bordering the river. The project started in 1988 and its aim was to raise the level of food security for the poor. The 70 participants (all women) were given demonstrations and assistance for a period of two years and left to continue on their own with only technical advice from the Society. The technologies offered are mainly bio-intensive, including the use of organic pesticides (Gathuru 1993b). The women cultivate their plots individually, although they are organised in a group, which has collective control of use and "ownership". Crops grown were meant to be mainly vegetables for consumption and the surplus for sale. Most project farmers were quite positive about the impact of the project on their food situation (Mwangi 1995). One aspect to be noted, however, is that the project also incorporates other income-generating activities and a shelter improvement project. Although there were also people who were less positive about the urban agriculture project, it shows at least that there is potential for organising farmers and securing land for long-term agricultural use.

9. Prospects for urban agriculture in Nairobi

One of the more conspicuous features about Nairobi is the fact that the city still contains many open spaces, which are or can be used for farming purposes. Most of the land used to be owned by either the local authorities or the government. During the last 20 years, however, more and more land has been sold to private developers with the aim of developing it for residential purposes. This is a process that has not only been going on until today, but will continue for a long time to come, as natural increase and in-migration will cause the city population to keep on growing rapidly. As a result, slowly but surely, most of the open spaces that still exist today will be entirely built up with houses, roads and the like. From this perspective, there is not a bright future for agricultural activities in the city, for the simple reason that agriculture cannot compete with other activities in terms of rewards.

However, besides the fact that farming in backyards is not likely to disappear, there will always remain open spaces, for instance along roads, railway lines and rivers, under power lines, etc. In other words, there is certainly potential to develop the sector. It is clear that the sector is seriously and chronically underdeveloped. It is not realistic to think that, in the very near future, urban farming will be something of the past. Many of the poor urban dwellers rely for their livelihoods to a smaller or larger extent on crop production or livestock rearing within the city boundaries. As long as there is no security of tenure, any effort to develop their farming is too risky. However, as the example of the Undugu Society project and the case of the Mathare Self-Help Group have shown, obtaining official permission to cultivate a piece of land is possible.

Many farmers are tilling plots that belong not to the local authorities, but to private landlords, and face a very uncertain future as far as their farming activities are concerned, because sooner or later the land will be developed for residential or other purposes. Still, these people could be very much helped by some form of temporary security regarding access to land. Organising themselves into a formal group (either with or without the assistance of a non-governmental organisation (NGO)) and then signing some kind of contract with the landowner, in which access to the land is guaranteed for a specific number of years, could be a great help to secure tenure, even though it is on a temporary basis. Then, at least, the farmers know where they stand.

Using solid waste – through production:
From Asian cities, we know that there is great potential to combine urban agriculture with such environmental considerations as solid waste disposal and treatment and use of sewage water. Using solid waste – through compost production – requires enormous financial and organisational investments, however. In the present economic situation, this is perhaps not the most realistic short-term option. Using sewage water for farming purposes is another matter. According to Ms Grootenhuis of the Green Towns Project, it is fairly easy to pipe the sewage water into a series of small ponds, in which the water becomes progressively cleaner, with the result that "the City would have less sewage water to dispose of and fewer infrastructure costs and food producers would have access to water for irrigation" (Dennery 1995: 77). Growing crops on hydroponics, possibly combined with fish farming, could be other uses. Still, this can be a realistic option only when the water is not too toxic.

Whatever effort is being undertaken to develop farming in Nairobi and particularly for the urban poor, without the local authorities' recognition that these people are permanent city residents, any actions on a scale of some size are not very likely to be successful. Formally, i.e., in terms of the City Council's policies, the urban poor hardly exist. On official maps of Nairobi, the informal residential areas (or slums) are not plotted. Specific programmes targeted at the urban poor in order to improve their nutritional situation do not exist, and they are also ignored as far as famine relief is concerned (Lee-Smith & Memon 1994). Hence, the first step to be taken has to come from the side of the Nairobi City authorities, namely, first, to admit that the slum dwellers are a fact of life, and secondly, to develop policies directed at the improvement of their living situation. Urban agriculture, then, should be part of such policies.

A second line to follow is a change of the attitudes of local governments as far as farming within town and city boundaries is concerned. For instance, in a Dutch initiative in Kenya called the Green Towns Movement (Duchhart & Grootenhuis 1993), local authorities in three selected towns (Eldoret, Nanyuki and Migori) received training in urban planning, with special emphasis on the integration of environmental issues in the Local Authorities Development Programmes. In this approach, proper urban agriculture is implicitly part of sustainable urban development. Another town in Kenya, Nakuru, is one of the four towns in the world included in a project called "Localising Agenda 21: Action Planning for Sustainable Urban Development". Funded by the Belgian Government, the objective of the project is to provide training in order to develop a new approach towards urban planning and management, focusing on environmentally-conscious development ("People's Green City"). Again, urban agriculture is part of this planning process.

The Nairobi City Council does support the Green Towns Movement, which is now implemented in twenty towns in the country (Munyua 1999). Planning includes the designation of “green zones” including riverbanks, road reserves and other open spaces. These areas are not meant for food production but for environmental conservation. “Informal food production” in these zones is not recognised. However, the kind of plants to be grown on the reserved land depends on the Ministries of Agriculture and Environment and on the local authorities. According to Munyua (1999), food production is reckoned with in the planning of medium- to low-density residential areas of Nairobi but not in high-density areas. In short, then, although the City Council does support the issue of “green cities”, its policy does not touch on anything concerning urban food production for the people who most need it, the poor.

Despite two general surveys and two studies in low-income areas, knowledge on urban farming in Nairobi is far from complete. What is needed is a complete picture of what farming in Nairobi constitutes, in all its aspects: the legal and institutional setting, the farming systems and farming techniques, the environmental issues, and the socio-economic aspects. Because farming in the city has grown substantially since the first two general surveys were made, a new general survey should be carried out, as well as a number of in-depth studies covering the above-mentioned aspects. Preferably, this should be one large, integrated study, in which the local authorities should be heavily involved. Only then will it be possible to design a policy aiming at both the creation of an environmentally sound city and the welfare of the poor.

1 The first study, a general survey in six Kenyan towns, was carried out in 1984-85 by the Mazingira Institute. In Nairobi, a total of 778 households were interviewed, among whom were 168 urban farmers (Lee-Smith et al. 1987, Lee-Smith et al. 1988, Lee-Smith & Memon 1994, Memon & Lee-Smith 1993). The second study consisted of a general survey among 618 cultivators all over Nairobi, carried out by Donald Freeman in 1987 (Freeman 1991, Freeman 1993, Lado 1990). The third study, conducted by Alice Mboganie Mwangi in 1994, focused on poor households only, notably 115 (including 48 farmers) in the Korogocho slum area, and 62 participating in an Urban Agriculture Project in Pumwani and Eastleigh Sub-Locations (Mwangi 1995, Mwangi & Foeken 1996, Foeken & Mwangi 1998). Finally, in the same year, Pascale Dennery did an anthropological study among a small number of urban farmers in Kibera (Dennery 1995, Dennery 1996).

2 Periurban agriculture refers to farming activities in the zone between the city boundaries and the rural areas, although it is often quite difficult and arbitrary to establish where “periurban” ends and “rural” begins.

3 This figure is based on the following assumptions: a) that the 1998 population is about 2 million (Kenya 1996a: 18); b) that an average household size of 3.3 persons (which is a conservative estimation; if the declining trend between 1979 (4.13; see Kenya 1981) and 1989 (3.46; see Kenya 1994) would continue along a straight line, the average household size in 1998 would be 3, and the estimated number of households practising urban farming would be 167,000); and c) that about 25% of the population of Nairobi is engaged in urban farming.

4 This is partly due to the sampling method (Lee-Smith et al. used households, while Freeman selected plots) and partly to the type of survey area (Lee-Smith et al. and Freeman covering the whole city area, while Mwangi's survey took place in two low-income areas only).

5 *Sukuma wiki* is a typical ingredient in the diet of the poor households, preferred as the usual supplement with the basic *ugali* dish (stiff maize porridge). It grows fast, gives high yields and has a high nutritional value.

6 Data from Freeman (1991) could not be included in this table, since he presents only the percentages of plots on which a certain crop was the "dominant" one.

7 The figures in Table 7 are calculated from data on livestock production presented by Lee-Smith et al. (1988) and an estimated number of households in Nairobi of 300,000 (based on Kenya 1981 and Kenya,1994). It should be noted that our estimation of the number of cattle is somewhat higher than that given by Memon & Lee-Smith (23,000), probably on account of the higher total number of households in our study.

8 Findings regarding the origin of energy intake (in kilocalories per consumer unit per day), (Mwangi & Foeken 1996):

	Farmers	**Non-farmers**
Origin of energy intake	*(N=48)*	*(N=67)*
from own urban production	263	-
provided by others	102	96
purchased	1539	1707
Total	**1904**	**1804**

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Appendix 1: Crops produced by Nairobi farmers*

Year of survey:	**1985 [a]**	**1994 [b]**	**1994 [b]**
Area	**Nairobi**	**Korogocho**	**Pumwani/E.**
N	**154**	**58**	**99**
Vegetables:			
Sukuma wiki	63	35	73
Onions/leafy onions	12	4	11
Leafy onions		10	24
Spinach	10	8	13
Cabbage	2	2	3
Tomatoes		23	31
Other vegetables	31	-	-
Amaranth		17	36
Egg plant		-	2
Legumes:			
Beans	38	71	73
Cow peas	12	33	24
Peas	1		
Garden peas		4	8
Pigeon peas		6	-
Green grams	-	-	2
Cereals:			
Maize	35	71	97
Sorghum		10	-
Finger millet		2	-
Other cereals	1	-	-
Root crops:			
Irish potatoes	14	23	26
Sweet potatoes	1	17	29
Arrowroot	1	21	26
Cassava	-	13	8
Other root crops	1	-	-
Fruits:			
Bananas	2	17	47
Citrus	1	-	-
Pumpkin	-	10	23
Cash crops:			
Sugarcane	-	4	13
Other cash crops	1	-	-
Napier grass		2	11

*) Data from Freeman (1991) are not included, as this study presents only percentages of plots on which a certain crop was “dominant”.

Sources: a) Lee-Smith et al. 1987; b) Mwangi 1995.

Appendix 2: Korogocho and Pumwani/Eastleigh: problems regarding urban agriculture

Area **Problems in (%) of households**	**Korogocho**	**Pumwani/Eastleigh**
Number of households	48	62
No problems (%)	-	-
Natural problems:		
Lack of rain (%)	13	7
Flooding (%)	2	19
Soil erosion	4	-
Pests/diseases	58	53
Poor yields	2	-
"Urban" problems:		
Access to land	4	2
No land security	4	18
Harassment	15	3
No technical advice	2	-
Transportation	2	-
Theft of crops	81	94
Lack of capital	29	16
Lack of inputs	10	10
Lack of tools	2	10
No assisting labour	-	2
Access to food for livestock	4	-
Plot used as toilet	-	31
Jealousy	2	-

Source: 1994 survey.

SHANGHAI: TRENDS TOWARDS SPECIALISED AND CAPITAL-INTENSIVE URBAN AGRICULTURE

Cai Yi-Zhong and Zhang Zhangen

1. Introduction

The Chinese are famous for their highly intensive urban cropping systems and to this day many of their large cities are largely self-sufficient in food from adjacent land areas administered by the city (Girardet 1999).

Shanghai, located in the delta of the Yangtze River, is the largest industrial and commercial city of China. The total area of Shanghai covers 6340.5 km^2, of which 13% is urban area and 87% rural. In the past ten years, Shanghai has been expanding rapidly, in 1994-95, for example, the built-up area increased by 22.4 km^2. Today, 13 million people live in Shanghai. The average population density is about 2,059 people/km^2, the highest density being in Nanshi District with 58,233 people/km^2. In order to reduce the population pressure in the town centre, the administration implements a policy of moving people to the fringes of the town, together with industries and facilities.

The Shanghai area is low and flat, with 50% of the land 4-5 m above sea level, the rest being even lower. Shanghai has a high density of watercourses and a rather high groundwater table. The subtropical climate, sufficient rainfall (1,143.4 mm/annum) and the soil make very suitable conditions for agriculture.

Shanghai has entered the fast lane of urbanisation, but the city administration also realises that the city will not be able to develop without agriculture. Agriculture in Shanghai contributes only 2% of the Gross Domestic Product (GDP) and the productivity increase is slower than in other economic sectors. The administration is aiming for a considerable level of agricultural production within the city in order to ensure a stable food supply for the urban population. To prevent more transfers from agricultural to non-agricultural land, strict regulation has been initiated. Currently, 80% of the arable land is protected under the Agricultural Protection Law. The government pursues capital-intensive agricultural development with a high degree of mechanisation and intensive use of land, labour and inputs. Today, the total amount of government investment in urban agriculture is five times higher than ten years ago. The objectives of the agricultural programmes are to maintain social stability, increase mechanisation and to increase production intensity. In addition, urban agriculture is seen as a way to reduce air pollution by maintaining green open spaces and by offering an opportunity for recreation.

2. Urban agriculture in Shanghai

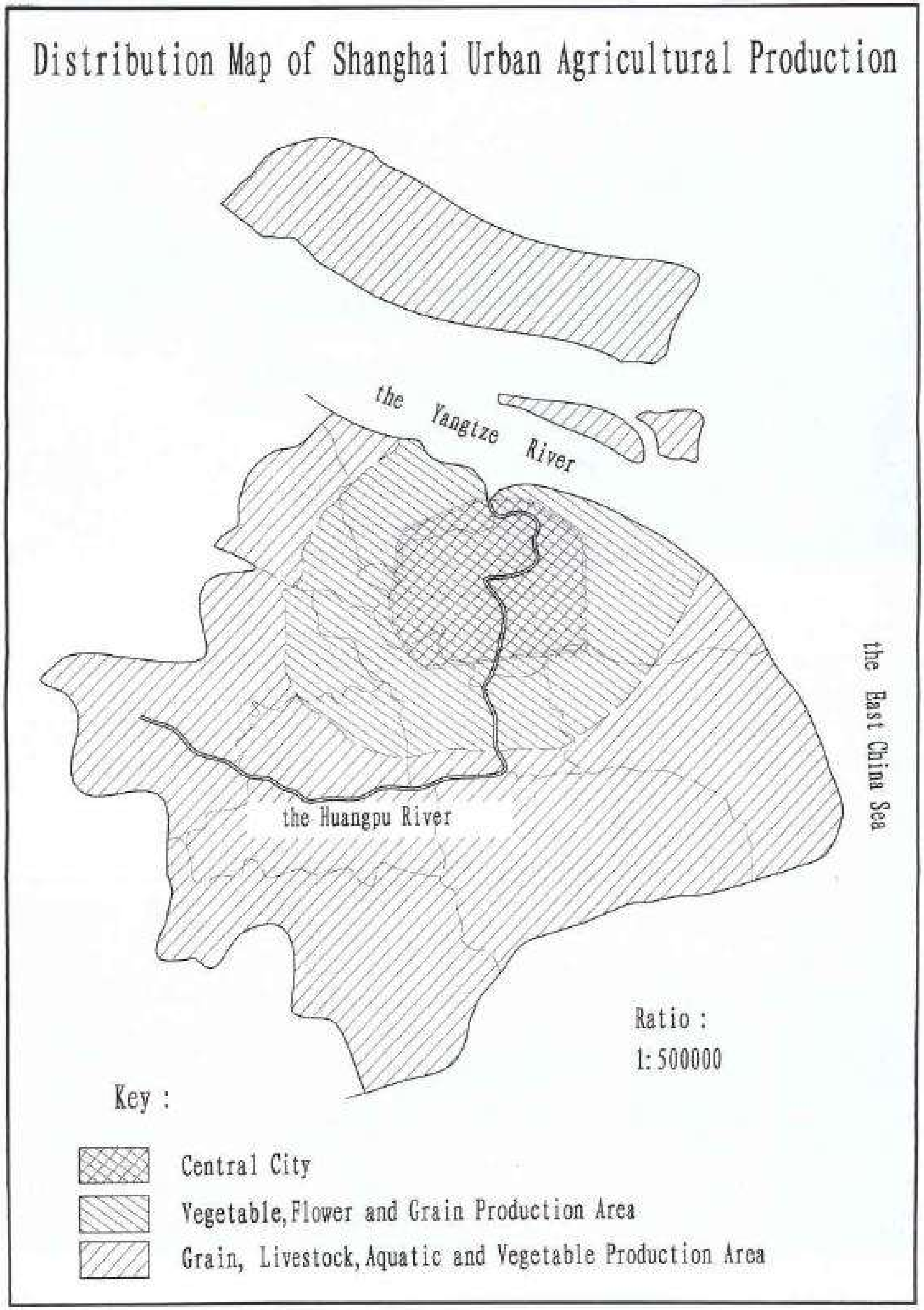
About 8.5 million people in Shanghai have a job, 3.6 million of these in the agricultural production sector. The total number of farmers is 2.7 million people, or 93% of the population of the rural areas around Shanghai (13% full-time farmers, 80% part-time farmers). Profits in urban agriculture in Shanghai are low. Competition for labour with other economic sectors is increasing. The production costs in the Shanghai area are on average 15% higher than in rural vegetable-producing areas. Increasingly, producers from other regions supply the Shanghai market, causing the prices to drop.

The main reasons for the higher costs are relatively higher labour and land costs. The strategy to reduce the price differences aims to increase output and to lower production costs per unit by applying new technologies and generating higher added value through improved production quality. Thirdly, agricultural production services are improved in order to reduce production costs. The relative advantage of lower transport costs in Shanghai is difficult to quantify, as it depends on the distance and modes of transport. It was this strategy to lower the production costs that led to a reduction in the price difference between rural production areas and Shanghai, from 20% to 15%.

2.1 Cereal production

It is a policy target for Shanghai to be self-sufficient in some cereals and to produce at least 2 million tons of grain per year. Cereal production is therefore given priority, and makes up 65% of the total production in Shanghai. In 1997, cereals were grown on 365,780 ha or 66.2% of the total area sown. Total cereal production was 2.4 million tons, of which 40% was wheat, with an average yield of 6.5 ton/ha. Wheat is produced in the summer. In the fall, mainly rice is produced, which amount to about 60% of the total cereal production.

Because growing summer grain crops such as wheat in the Shanghai area are not economically profitable, the area under cereal production declined from 512,307 to 343,951 ha over the period from 1979 to 1995.


Distribution Map of Shanghai Urban Agricultural Production
the Yangtze River
the East China Sea
the Huangpu River
Ratio :
1: 500000
Key :
Central City
Vegetable, Flower and Grain Production Area
Grain, Livestock, Aquatic and Vegetable Production Area

In Shanghai greenhouses are used to prevent contamination of crops by air and soil pollution (Picture Shanghai Modern Agriculture Development).

However, the total production remained at about 2 million tons on account of an increased yield per hectare (from 5.1 t/ha to 6.4 t/ha).

2.2 Vegetable production

Vegetable production covers more than 10,000 ha under continuous production and 2,700 ha under seasonal production. Before the 1990s, continuous vegetable production was concentrated in the suburbs within a radius of 20 km around the city centre. Since 1990, the vegetable production area has gradually moved out as the city has expanded. In 1996, 75% of the land under vegetable production (8,700 ha) had been moved to the outskirts. Only 10% of vegetable-production land will remain in the periurban area of the city; the rest will be located at 30-60 km from the city centre.

The already mentioned increased competition and higher production costs have caused the self-supply for vegetables in Shanghai to drop from 100% to 60%. The annual vegetable production in Shanghai is about 1.3 million tons, or 4,000 tons per day.

Vegetable production in Shanghai is relatively specialised. The number of greenhouses is increasing and now covers 26.7% of the total vegetable production area. The government actively promotes new technology in 287 horticultural farms. A 700 ha greenbelt has been established in which 18 kinds of vegetables and fruit are produced.

2.3 Livestock production

Livestock production has also been gradually moved from the suburbs to the outer area of Shanghai. At the moment, there are 547 large-scale pig farms, of which 88 have more than 10,000 pigs. There are more than 100 broiler chicken farms with a production capacity of over 100,000 birds each and 120 egg production farms with more than 10,000 chickens each. There are also 150 dairy farms, each with more than 100 head of cattle. Pork, chickens and eggs produced by these farms account for half of total commercial production, and milk for 80%. Pork and poultry cater for more than half of the total supply to the city. Respectively, 100% and 90% of the milk and eggs consumed in Shanghai is produced within the city limits.

Apart from food crops and livestock, there are several enterprises engaged in producing turf grass covering in total 143 ha, and there are 43 floriculture farms producing 290 million tons of cut flowers a year (33% of the total production in China). The average size of these farms is 3 ha.

3. Trends in agricultural production systems

The urban agricultural production process has been reorganised, with small-scale household production giving way to large-scale farms. The policy is to organise the production chain vertically, integrating production, processing and marketing. In the past few years, ten large and 200 medium-sized agricultural production and processing companies have been set up. In this vertical chain, the intention is to increase the added value. On average, marketing and processing add 1.5 times the value to the original products. Marketing is mainly done by the 21 vegetable wholesale markets in Shanghai. In addition, there are 270 farmers' organisations for vegetable transport and sale.

In Shanghai, the trend is moving towards specialised production systems in order to benefit from economies of scale and to increase production levels through increased specialisation. However, there are still small-scale household farms with mixed production of cereals, vegetables and animals. To support the process of specialisation, townships have established agricultural service groups that provide farmers and various managing organisations with pre-, mid- and post-production services.

Most of the tasks in urban agriculture, such as ploughing, irrigation, weeding and harvesting, have been mechanised, and computers are increasingly being used to monitor the production processes. The degree of mechanisation is relatively high, reducing labour requirements in agriculture. For example, yields per hectare of wheat and have rice increased 5-10%, while the labour productivity has doubled. Around 10,000 ha of land have been drained and 12,4000 ha are now irrigated by a low-pressure pipe-irrigation system.

With an increased standard of living, questions are being raised in Shanghai as well, regarding the quality of agricultural products and the need to avoid crop contamination and environmental pollution by farming practices. The first solution is technical. Crops are grown in closed greenhouses in order to avoid uptake of pollution by the plants. Tests show that, in these greenhouses, crop contamination as well as indicators for pollution of soil, water and air are significantly lower than in open-land production. The second strategy is a move towards organic farming. In Qianwei Village, for example, 67 ha of land are used for low-input vegetable production. All the organic waste of the production is used to produce bio-gas, reducing the use of non-renewable energy. All crop residues are composted and applied to the fields, reducing the need for chemical fertilisers. Biological methods are used to control weeds, pests and diseases. The third strategy is to plan sites for agricultural development in non-polluted areas far away from sources of pollution. An example of this is in Congming County, where the biggest green-food production base in Shanghai is currently being constructed.

3.1 Urban agriculture, recreation and environment

Urban agriculture plays a role in recreational activities. A popular Chinese activity is to visit parks and gardens. Every spring in Shanghai, hundreds of thousands of citizens visit agricultural areas for sightseeing purposes. Some entrepreneurs are actually considering building agricultural holiday resorts in the suburbs of Shanghai. Apart from individual sightseeing, several festivals are organised like the Peach Flower and the Osmanthus Flower Festivals. The function of these festivals is to advertise the products, to promote trade and to provide leisure to urban citizens.

Shanghai has limited green areas and boasts only 40 parks. The total available green space per person is 1.15 m^2, which is far below the Chinese average of 4 m^2, not to mention the world average of 50 m^2. To address this situation, among other things, the structure of the agricultural land is being adjusted without affecting its nature. Urban agriculture together with open green space management is to be included in the overall city development plans.

4. Constraints and outlook for urban agriculture

The main constraints to urban agriculture are the increasing pressure on land and the consequently dwindling land resources for agriculture. From 1978 to 1995, the available arable land in Shanghai decreased from 360,000 to 290,000 ha. From 1992 to 1994, the amount of arable land decreased by another 26,000 ha. However, since the Agricultural Protection Law in 1998, the loss of agricultural resources has been brought under control.

Other constraints include the relatively low income from agriculture and the relatively higher costs compared to other agricultural production areas, as well as the environmental problems of Shanghai. The strategy pursued for the development of urban agriculture is further mechanisation and technical innovation. For this, modern biological and information technologies must be applied.

The production should be market-oriented and should provide self-sufficiency to the suburbs around Shanghai as well as contributing to the provision of cereals and fresh food to the city. Increasing, importance should be attached to healthy and safe food. Ecological and cultural functions are supplementary to the economic development objectives.

1 Shanghai Modern Agriculture Development Company

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SOFIA: URBAN AGRICULTURE IN AN ECONOMY IN TRANSITION

Antoaneta Yoveva, Boriana Gocheva, Galya Voykova, Boris Borissov, Al Spassov

1. Introduction

Bulgaria is located on the Balkan peninsula in the Black Sea. The surface of Bulgaria covers 111,000 km^2. In general, the natural conditions in Bulgaria are favourable for agriculture. Summers are pleasant, autumn is windless, sunny and colourful, and the winters cold.
The average winter temperature is 1.6°C, summer average is 21°C, mean annual temperature is 10°C. The mean annual rainfall is 813.6 mm.

Sofia is located at 42.7° N and 23° E in the southern part of the Sofia Plain, at the foot of the Vitosha and Lyulin Mountains. The city covers 1,326 km^2. The average altitude of Sofia is 550 m above sea level. Major soil types of the Sofia Plain are maroon sandy soils, alluvial and illuvial sand and clay and black earth (humus).

Like in most Central and Eastern European countries, the total population in Bulgaria, presently 8,283,200 people, is declining. At the same time, the population in urban areas is increasing. Also the average age of the population in Bulgaria is increasing. About 15% of the country's population, or 1,182,600 people, lives in Sofia, the largest city in Bulgaria, in about 480,580 dwellings. The population density of the city is 908 per km^2.

1.1 The urban structure of Sofia

The city of Sofia has a compact central part, the old historical town centre, in which 1,114,168 people live, but Sofia also includes three towns with in total 25,198 people, as well as 34 small villages, villa zones and a periurban zone which are home to 51,181 people (National Statistical Institute 1998). The town is divided into 24 districts, each with its own centre (and subcentres).

Sofia is still remarkably green, with parks, gardens and other public green areas. However, the natural vegetation is decreasing. The major city parks altogether cover an area of 2,700 ha. Most of the parks stretch from the central part of the city to the periphery and thus connect green areas with the suburban and villa zones. There are regional parks in each of the residential zones, while the central city area has several historical gardens and memorials. (Sofia Municipality 1987).

2. Urban agriculture in Sofia

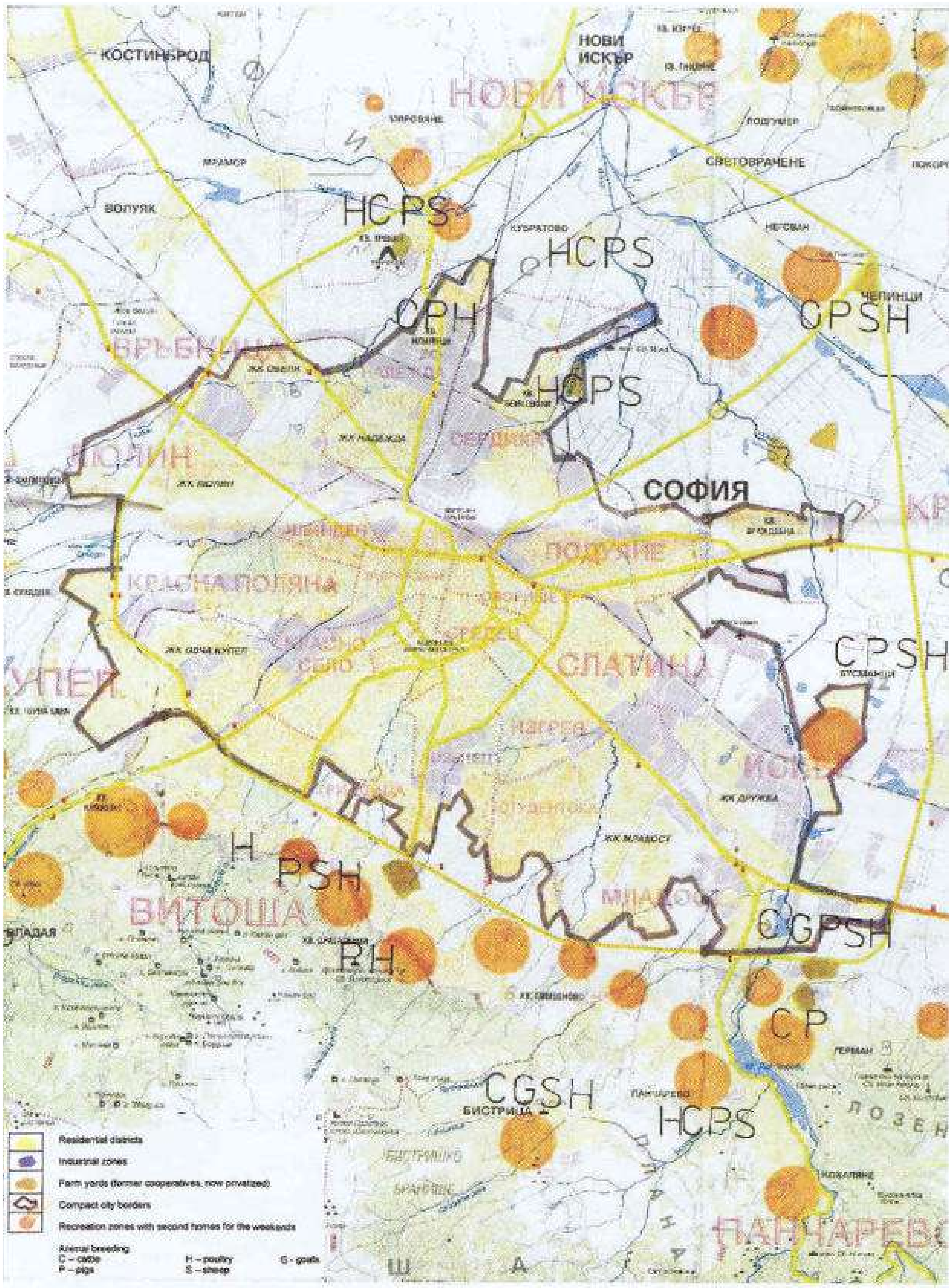
Urban agriculture has been an essential element of Bulgarian life for centuries. It is typical for all cities, including the capital. In all the villages of the Sofia municipality, in the city outskirts and in central parts of the city, private gardens and backyards produce food, which is often also processed at home. Unlike in, for example, the USSR, private ownership of small plots of land both in rural and urban areas was never abolished.

Officially, only 2% of the economically active population is engaged full-time in agriculture. However, approximately half of Sofia households are engaged in cultivating fruit, vegetables and spices, and more than 90% make preserves and pickles out of home-grown or purchased agricultural produce. The percentage of households in Sofia achieving self-sufficiency in different foods (either self-produced or processed by friends and relatives up country) is about 14% (UNDP 1998).

The transition period from a socialist to market-oriented economy has caused the collapse of the agricultural co-operatives and state farms. This process was followed by slow privatisation and lagging agricultural reform. This also affects the organisation and land use in urban agriculture.

2.1 Changes in land use

Land use is in a state of transition. The periurban villages to the south of Sofia (Dragalevtzi, Simeonovo and Pancharevo) are no longer areas of agricultural production, as they were strongly urbanised during the past ten years. In the compact city, agricultural land has been turned into housing complexes, e.g., the districts of Mladost and Darvenitza were constructed on fertile agricultural land.


КОСТИНБРОД
НОВИ ИСКЪР
НОВИ ИСКЪР
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HCPS
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ВРЪБНИЦА
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СОФИЯ
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КРАСНА ПОЛЯНА
СЛАТИНА
CPSH
ИЗГРЕВ
ЖК ДРУЖБА
ЖК МЛАДОСТ
H
PSH
ВИТОША
PH
CGPSH
CP
CGSH
БИСТРИЦА
ПАНЧАРЕВО
HCPS
ЛОЗЕН
ПАНЧАРЕВО
Residential districts
Industrial zones
Farm yards (former cooperatives, now privatized)
Compact city borders
Recreation zones with second homes for the weekends
Animal breeding
C – cattle
P – pigs
H – poultry
S – sheep
G - goats

In the periphery of Sofia many vegetables are grown and animals kept for self-supply (Picture Antoaneta Yoveva)

Garden produce is often sold directly on the street (Picture Antoaneta Yoveva)

In the southern areas of the capital (Malinova Dolina and Hladilnika), houses were also constructed. The urban sprawl competes directly with land available for agriculture.

Table 1: ***Land use in the municipality of Sofia***

Total area in ha	**132,613.2**	**100 %**
Agriculture	54,738.4	41%
Forestry	44,854.8	34%
Housing etc.	24,494.7	18%
Water	4,399.2	3%
Roads, railways and transport	2,054.6	2%
Mining	2,071.5	2%

Source: National Statistical Institute 1998

Part of the loss of agricultural land can be attributed to the owners, who received their property back after the transition from a centrally-planned to a market-oriented economy. Most of them tried to realise a maximum profit from their land and requested changes in the land-use allocation from farmland towards residential zoning. Such a change in designation increases the potential economic value of the land but reduces the land availability in the city area.

2.2 Types of urban agriculture

For Sofia municipality, two basic types of urban agriculture can be distinguished: namely, private farms and urban household agriculture.

2.2.i Private farms

Small private farms on the borders of the city and in the neighbouring villages produce meat, fruit and vegetables. Some of these farms are combined with micro-enterprises for processing agricultural production. These private farms are usually located on private restituted land or, since December 1990, in privatised former “state farms”. In the 1970s, it was realised that the demand for agricultural produce could not be met. State-owned land was issued for agricultural use to private farmers on a temporary basis. The areas for these farms ranged from 0.1 to 1.0 ha. On these farms, mainly vegetables, fruit and animals for home consumption are produced. Most of the animals are kept in the private yards of farmers or in adapted old buildings. A private farmer usually owns 1-3 cows, 1-5 goats and a few other small animals – sheep, pigs, etc.

2.2.ii Urban household agriculture

Urban household agriculture assumes at least three different forms:

- *farming in backyards and private gardens* adjacent to family houses - this is typical both for the villages surrounding Sofia and the city itself and, in the case of the villages, is usually combined with poultry raising and the keeping of other small livestock;
- *farming and livestock keeping in gardens of second homes or summerhouses* located in designated recreational zones, owned by Sofia families. The houses are located within 100 km from the urban centre in the periurban areas. These so-called "villa zones" were developed in the socialist era to compensate for the life in prefabricated complexes in the urban environment. People from the city needed recreational areas and a green environment. In this way, the migrants could maintain their habits and desire to have individual homes with yards. However, in the 1980s and 1990s, fuelled by an increased standard of living, the construction of villas went out of control. In the 1980s, one third of the population of Sofia received plots for recreation (as planned, see Table 2). This area was considered to be reserved for future residential zones; and

Table 2: ***Areas for urban agriculture and recreation in ha***

Agricultural land (in ha)		**Recreational land (in ha)**
Villa zones	2,233	22,000
Farmland with (max. 35 m^2) and without permission for construction	610	8,000
Total for the capital periphery	2,463	24,700

Source: Programme for protection and reproduction of the natural environment in Sofia by the year 2000. 1987

- *farmland provided under State Decrees* for self-supply of vegetables for families in the villages around Sofia. From 1970 to 1985, State-owned farmland was issued to people under different State Decrees for temporary use. This land was for recreation and for self-supply of fruits and vegetables. Zones for self-supply were formed; their location, in many cases, was next to designated villa zones. On some plots, the construction of buildings of limited size (max. 35 m^2) for seasonal use was allowed. However, illegal construction and violations of building rules often took place. Worse was that attractive areas bordering existing villages or villa zones were illegally seized, fenced and turned into recreation plots. Such areas are typical for the regions around the villages

German, Lozen and Pancharevo, at the foot of the Balkan and Vitosha Mountains.

One can also observe a trend to grow food around the housing compounds along the riverbanks and in other vacant spaces where the public green is not maintained or in places entirely neglected by the municipalities.

2.3 Urban agricultural production

The most commonly grown vegetables around Sofia are cabbage, potatoes, onions and beetroot.
The larger private farms around Sofia produce grains, vegetables, fruit and animals on a large scale. Most of the agricultural production comes from Kniazhevo, Vladaya, Bojourishte, Kostinbrod, Voluyak, New Iskar, Benkovski and Svetovrachane.

In Sofia, only information on the marketed produce is available. Since a large part of the production is for subsistence and thus not marketed, this information can provide only a limited insight into the importance of urban agricultural production.

Table 3: ***Cultivated area and yields (1996)***

Vegetables	**Surface area (in ha)**	**Production (in tons)**
Tomatoes	387	4,100
Cucumbers	133	1,400
Green pepper	197	1,900
Cabbage	444	7,300
Strawberries	317	700

Source: National Statistical Institute 1997

In the growing season, direct sales by urban farmers at the largest auction in the residential complex Drouzhba amounts to 380 tons per day. This production comes from both the northern and eastern areas of Sofia. For all the open markets in Sofia, the production is estimated at about 1,000 tons per day.

The private small farms in Sofia keep 92% of the cattle, 98% of the goats, 100% of the sheep, 93% of the poultry and 92% of the pigs in the city (National Statistical Institute 1997).

Table 4: ***Animal production in Sofia (1997)***

Animals	Number	Production in tons
Cows	7609	16337 (milk)
Goats	9268	185 (milk)
Sheep	24640	1633 (milk) 84 (wool)
Pigs	21133	2110 (meat)
Chickens	219122	
Beef, chicken and mouton meat		3810 meat
Chicken eggs	23812000	

Source: National Statistical Institute 1998

2.4 Marketing and processing of urban agricultural production

Agricultural production which is not directly consumed is either processed or marketed through various channels:

- the auction (in the case of non-perishables);
- the open markets (in the case of the more attractive goods);
- direct sales by the producers; and
- middlemen who buy vegetable and animal products for processing.

The markets are located in the densely-populated urban quarters. Each of the central communities has at least one open market. The markets are managed by specialised municipal enterprises and strictly controlled by the respective sanitary authorities. The markets in the southern city districts are supplied from the countryside. In this area, residential complexes were recently constructed. The local people, who used to produce their own food, have now become consumers who buy their food in the markets. The northern districts of Sofia are supplied by producers from the neighbouring villages, where agricultural production has increased in recent years.

However, most households process almost all their crop and animal production at home, to prepare food supplies for the winter. Part of the agricultural production is canned or pickled. The fruit is processed into stewed fruit or jams. Fruit and grapes are also used to make home-made brandy. Some of the processed production is also sold.

The animal products are processed in private dairies and in meat-processing plants for sausage production. Private entrepreneurs operating as middlemen supply leather to leather plants.

3. Urban agriculture in a country in transition

Sofia has some specific issues, emerging from the transition from a socialist to a capitalist system, which has had an impact on urban agriculture and its role in the city.

3.1 Urban agriculture and the household economy

Since the early 1990s, profound changes have taken place in the society and economy in Sofia. Prices increased while wages remained the same, and many people lost their jobs. Economic insecurity increased and so did the informal sector. As a result of this political transition, two severe humanitarian and food crises occurred: the first from late 1990 to early 1991 (winter); and the second from late 1996 to early 1997 (winter). During these crises, urban agriculture remained the most important way to overcome food shortages and was a strong stabilising factor for the food security of the population of Sofia. As is typical for low-income urban families, home-based production played a role in increasing food security (UNDP 1998). By engaging in household agriculture and domestic processing, families also avoided the serious seasonal fluctuations in the market prices of fruit and vegetables, and the relatively high prices of preserves and canned foods.

Urban farmers live in the periurban areas or in the villages around Sofia. Most are retired or have a job and do backyard farming in their free time. The primary aim of production is to contribute to subsistence needs; only excess production is marketed. In 1997, roughly 28% of the households in Sofia acquired some income from private farm production. Urban agriculture is a steady and quite high source of in-kind household income, while cash income from urban farming is often irregular (Bulgarian Early Warning Report 1998). In the period 1992-95, the products of urban agriculture officially represented only 1% - 2.6% of the total income of individuals and households in Sofia (National Statistical Institute 1997; 1998). However, as a rule, most agricultural activities are not registered and people do not declare the income from sales of agricultural products.

Although the service sector and manufacturing industry in Sofia are the greatest employers, the agricultural “black” and “grey” labour market is significant in size. Officially, 13,400 people are employed in agriculture. Total employment numbers are much higher than the official statistics, because of informal employment and self-employment. The typical characteristics of actors on the (informal) urban agricultural labour market are:

- family members and self-employed without strict registration requirements and tax obligations;
- unskilled workers, unemployed for a long period, who are hired occasionally or for seasonal jobs; retired people, students and even children are also employed in urban agriculture; and
- people developing small businesses, and people employed in state enterprises and government agencies often working seasonally or in their free time (UNDP 1998).

3.2 Environmental pollution and urban agriculture

The traditional focus on heavy industry in socialist Bulgaria had a severe impact on soil, air and water pollution in Sofia. According to a 1989 survey, about 78% of the agricultural land in Sofia is polluted (Spassov et al. 1994); 37% of the farmland is classified as degraded, meaning that land in these areas has lost its agricultural and environmental functions.

The metallurgical plant Kremikovtzi alone pollutes an area of 3,374 ha and contaminates about 200 ha of agricultural land with heavy metals. In the Kremikovtzi village area, 87.3% of the 5,790 ha is polluted above the permissible concentration levels. Another example is Novi Iskar, where a 1996 survey found that, in 18 out of 34 soil samples from farmland and backyards, the lead concentration exceeded norms by 1.5 to 14 times; 4 samples contained zinc up to 4 times the highest permissible concentration (HPC), and in one test copper levels were three times the limits of permissible concentration (LPC) (State Gazette 43, 1997).

The impact of this pollution on crops became clear from a survey in the Kremikovtzi area (see Table 5): 86% of the samples were medium-polluted arable soil, 8.9% heavily polluted and 1.8% extremely heavily polluted.

Table 5: ***Number of cases of pollution exceeding LPC in crops***

Element	**Cereals**		**Vegetables**		**Fodder**		**Cases**	
	>LPC	<LPC	>LPC	<LPC	>LPC	<LPC	>LPC	<LPC
Cadmium	0	8	3	19	1	14	4	41
Lead	0	8	0	22	1	14	1	44
Copper	0	8	0	22	0	15	0	45
Zinc	0	8	6	16	0	15	6	39
Arsenic	1	7	0	22	0	15	1	44
Total samples	**8**		**22**		**15**		**45**	

Source: Spassov et al. 1993

The main sources of air pollution in Sofia are the metallurgy and energy plants. These industries lack advanced pollution controls and purification technologies, and use low-quality raw materials. The concentration of contaminants in the atmosphere in Sofia exceeds the sanitary standards. The average atmospheric pollution is 5.8 HPC. The calm weather during most of the year causes retention of the emissions and contamination of industrial zones, the surrounding villages and the eastern residential areas (National Centre for Sustainable Development 1997).

The water of the Iskar-Lesnovska, Kakach and Blato Rivers is not suitable for any agricultural use according to findings of a 1997 study, and is qualified as highly polluted. The inspection of Kakach River, in which industrial and household wastewater is released, reports the highest degree of water pollution, including severe contamination with oil products (National Centre for Sustainable Development 1997, Pelovski 1998). However, all of these rivers are being used as a watering source for domestic animals. Two tests of local drinking water sources show concentrations of ammonia, nitrites, nitrates, lead, iron and zinc to be above acceptable limits, and also the presence of phosphates. With these levels of pollution, the two sources are suitable neither for domestic use nor for irrigation of leafy vegetables and fruit (Spassov et al. 1994, JICA).

3.3 Institutional mechanisms

Because of reduced budgets and a policy to reduce the role of the government, as a reaction to the strong State in the socialist era, enforcement of existing regulations has become more difficult. On the other hand, most regulations do exist and government institutions still have highly-qualified staff and regulatory frameworks inherited form the socialist era (e.g. for land-use planning, construction and environmental protection). In the 1980s, new legal statutes were introduced to allocate appropriate land use. Special measures were taken to preserve the areas for self-supply, as their importance was well recognised, and to reduce and regulate the construction of second homes. However, on account of the political transition, the implementation and enforcement of such measures has become problematic. A clear example is the law for protection of farmland, which was to inhibit construction on agricultural land (State Gazette 35, 1996). Now, with the land returned to the private owners, the land-use allocation has been easily changed, resulting in house construction on farmland.

Bulgaria has a strict system of sanitary-hygienic standards. This permits the monitoring of serious controls and the imposition of restrictive land-use regimes, if necessary. These standards are currently also imposed to bring the Bulgarian standards in line with EU regulations (State Gazette 39, 1984; Tenev 1995), and a host of organisations is involved in monitoring and enforcing environmental regulations.

The “Regulation for qualification and marketing of fresh fruits and vegetables” is meant to guarantee control over all movements of goods and products from the yard to the market. The Law for Trade will establish strict regulations on traders in the future. Proper documentation of quality will be required for each product offered on the market (Panayotova 1998, Hadgievea 1997). The auctions and open markets are supervised by the State Veterinary Sanitary Control and the Hygiene and Epidemiology Inspectorate. There are mobile laboratories on the spot, for example, checking the nitrate concentration (State Gazette 46, 1994; 89, 1996). The process is transparent and everyone can check the quality of the products.

4. Prospects and constraints for urban agriculture in Sofia

In Sofia, there exists a good knowledge infrastructure as well as sufficient qualified staff to integrate urban agriculture into town planning in order to minimise health risks associated with urban agriculture and to provide support to its development.

The continuing urban sprawl facilitated by less strict control of regulations extends into the periurban zones, where traditionally much urban farming was done. These zones are becoming densely-populated residential areas; this reduces the availability of farmland. At the same time, the newly rich no longer produce food themselves but seek clean food products from the farmers in the neighbourhood.

After 10 November 1990, a process was started, to return agricultural land to its former (pre-socialist era) owners. This is a slow process, because many disputes and difficulties have arisen. An especially large number of problems arose concerning the land close to large cities. Often this land in villa zones was issued under the State Decrees for self-supply, with permission to construct buildings up to 35 m^2 big. The former owner then received a plot with a building on it which belonged to the new owner. Consequently, either the new owner has to buy the land back, or the previous owner must buy the building from the new owner. In Sofia, 42.4% of the land has not yet been returned to the former owners. Farming is done with temporary land-use rights which inhibits long-term investment in improving the land.

The unclear land-tenure situation and slow adoption of the laws have resulted in a non-existent market for agricultural land. It is difficult to obtain credit for agriculture as land is not accepted as collateral. The few possibilities that do exist to obtain loans have requirements which are difficult to be met by farmers in the informal sector. However, the process of restitution of land has sped up over the last two years and should be finalised in the second half of 1999. Secure land status can give new opportunities to enhance private farming initiatives, self-employment and self-supply with agricultural products (Doichinova 1996).

A prime factor encouraging farming around Sofia is the proximity of markets for the agricultural produce. The central markets are one to one and a half hours away from the outermost parts of Sofia is 1-1.5 hours, which ensures minimal transport time and expenses. The urban and periurban farmers can offer their products directly at the markets, without middlemen. They can also open their own retail stores to sell their products directly. Another advantage of the short distances is that it is easy to sell perishables. People from the high-density areas are even prepared to travel to the peripheral areas of Sofia, where they can buy fresh milk and other milk products directly from the farmers.

There is a trend to reduce the use of chemical fertilisers on account of their high price, while the use of natural fertilisers increases. Urban farming is thus increasingly less likely to contribute to pollution and, at the same time, it creates opportunities for waste recycling by composting. There remains, however, the danger of contaminated crops, which is currently difficult to control since such a large part of the production is not marketed but rather consumed at home. On the other hand, environmental awareness and concerns over industrial pollution are increasing. Institutional control should improve, as well as the provision of information on contamination and health risks in the moderately and highly polluted lands.

Vacant plots in residential areas can be turned into community gardens. The inhabitants from the neighbourhood could acquire plots in these gardens to grow vegetables or flowers. Community gardening is an opportunity to increase social exchange, to improve the environment, to raise the value of property and to increase the safety of neighbourhoods.

The growing of vegetables on rooftops, in schoolyards, balconies and on idle lands is also possible and would be beneficial for Sofia. Land-use planning can enhance the use of neglected areas for urban farming. Mini-farming and school gardening can provide on-the-job training for young people and the permanently unemployed. Among other positive social effects of gardening is that it could be used as a therapy and improved self-support for mentally and physically disabled people, drug addicts, etc.

Municipal strategies are needed to further promote private initiative in urban farming. Measures such as extension of cheap credits for agriculture, creation of a municipal agricultural investment fund, promotion of foreign investment in the processing of local agricultural production and reduction of the production risks can support the process of stabilising private urban farming. Strong linkages still exist between urban families and the rural areas, along with a tradition of agricultural production on a limited scale. This is an enormous asset in further developing urban agriculture in Sofia.

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Acronyms used

ACPA	Cuban Association of Animal Production
BMZ	German Ministry for International Cooperation and Development
CAO	City Agricultural Office (Philippines)
CASOL	*Cooperativa Agrícola de Comercialización Solidaridad* (Commercial Solidarity Agricultural Co-operative), Bolivia
CBD	Central Business District (Harare)
CBO	Community-Based Organisation
CDH	*Centre de développement de l'horticulture* (Centre for Horticultural Development), Senegal
CEED	City Economic Enterprise Department (Philippines)
CFS	Community Food Security
CIDA	Canadian International Development Agency
CIDAG	Centre for Research and Development of Self-Management, Peru
CIRAD	*Centre de coopération internationale en recherche agronomique pour le développement (*Centre for International Co-operation in Agricultural Research for Development), France
COAG	Committee on Agriculture of the United Nations
CREE	*Centro de Producción de Entomófagos y Entomopatógenos* (Centre for the Reproduction of Biological Controls), Cuba
CSU	Co-operative Supply Units (Cuba)
CTA	Centre for Technical Co-operation in Agriculture
CUD	*Communauté urbaine de Dakar* (Urban Community of Dakar)
DANIDA	Danish International Development Agency
DKI	*Daerah Khusus Ibukota* (Special Capital City Region, in this case, of Jakarta)
DPS	*Direction de la Prévision et de la Statistique* (Management of Calculations and Statistics), Senegal
DSE	German Foundation for International Development
ECAM	*Enquête de consommation alimentaire auprès des ménages* (Survey of household food consumption), Senegal
EDA	*Environnement et développement en Afrique (*Environment and Development in Africa)
ENDA	Environment & Development Activities (Zimbabwe)
EPA	Environmental Protection Agency
EPM	environmental planning and management
ESAP	Enhanced Structural Adjustment Program
ETC	Consultants in Development Programmes (The Netherlands)
EU	European Union

FAO	Food and Agriculture Organisation (UN)
FCFA	*Franc de la communauté financière d'Afrique* (Franc of the Financial Community of Africa)
FCG & CG	Federation of City Farms and Community Gardens (UK)
FLHOR	*Département des productions fruitières et horticoles* (Department for the Production of Fruit and Garden Products), Senegal
FSDS	food supply and distribution system
GDP	Gross Domestic Product
GIE	*Groupement d'intérêt économique* (Organisation for Joint Economic Interests)
GNP	Gross National Product
GRS	*Groupe de relance stratégique* (Group for Strategic Stimulation)
GTZ	German Agency for Technical Cooperation
HPC	highest permissible concentration
IDRC	International Development Research Centre
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IPM	Integrated Pest Management
ISRA	*Institut sénégalais de recherche agronomique* (Senegal Institute for Agricultural Research)
LDC	Less Developed Country
LETS	Local Employment Trading System
LGU	Local Government Units
LPC	limits of permissible concentration
LPG	liquid petroleum gas
MCMZ	Mexico City Metropolitan Zone
MEACC	*Mission d'étude et d'aménagement du canal du Cayors* (Mission for Studying and Building the Cayors Canal)
MinCARRD	Mindanao Consortium for Agricultural Research and Rural Development
MoA	Ministry of Agriculture
MST	*Movimento Sem Terra (*Landless Movement) in Brazil
NEDA	Netherlands Development Agency (now DGIS)
NGO	Non-Governmental Organisation
ODA	Overseas Development Assistance, UK
PHilDHRRA	Philippine Partnership for the Development of Human Resources in the Rural Areas
POs	People's Organisations.
PUVeP	Periurban Vegetable Project
SCP-TZ	Sustainable Cities Programme in Tanzania
SDE	*Sénégalaise des eaux* (Senegal Water Company)

SDP	Sustainable Dar es Salaam Project
Sida	Swedish International Development Agency
SONEES	*Société nationale d'exploitation des eaux du Sénégal* (National Society for the Exploitation of the Waters of Senegal)
SPM	Suspended Particulate Matters
SWEDEPLAN	
TUAN	The Urban Agriculture Network
UA	Urban Agriculture
UBPC	*Unidades Básicas de Producción Cooperativa (*Basic production co-operative units), Cuba
UGOS	Urban Green Open Spaces
UICN	*Union mondiale pour la nature* (International Association for Nature)
UMP	Urban Management Programme (under the UNDP)
UNCHS	United Nations Centre for Habitable Settlements
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFP	United Nations Population Fund
UNICEF	United Nations Children's Fund
UNSCP	United Nations Sustainable Cities Programme
WB	World Bank
WHH	German AgroAction
WHO	World Health Organisation
WSAA	World Sustainable Agriculture Association
WTO	World Trade Organisation
ZUP	*Zone d'utilité publique* (Zone of Public Use)

Measurements

Ha	Hectare (= 2.47 acres)
Acre	(= 0.405 ha)
t	Tons