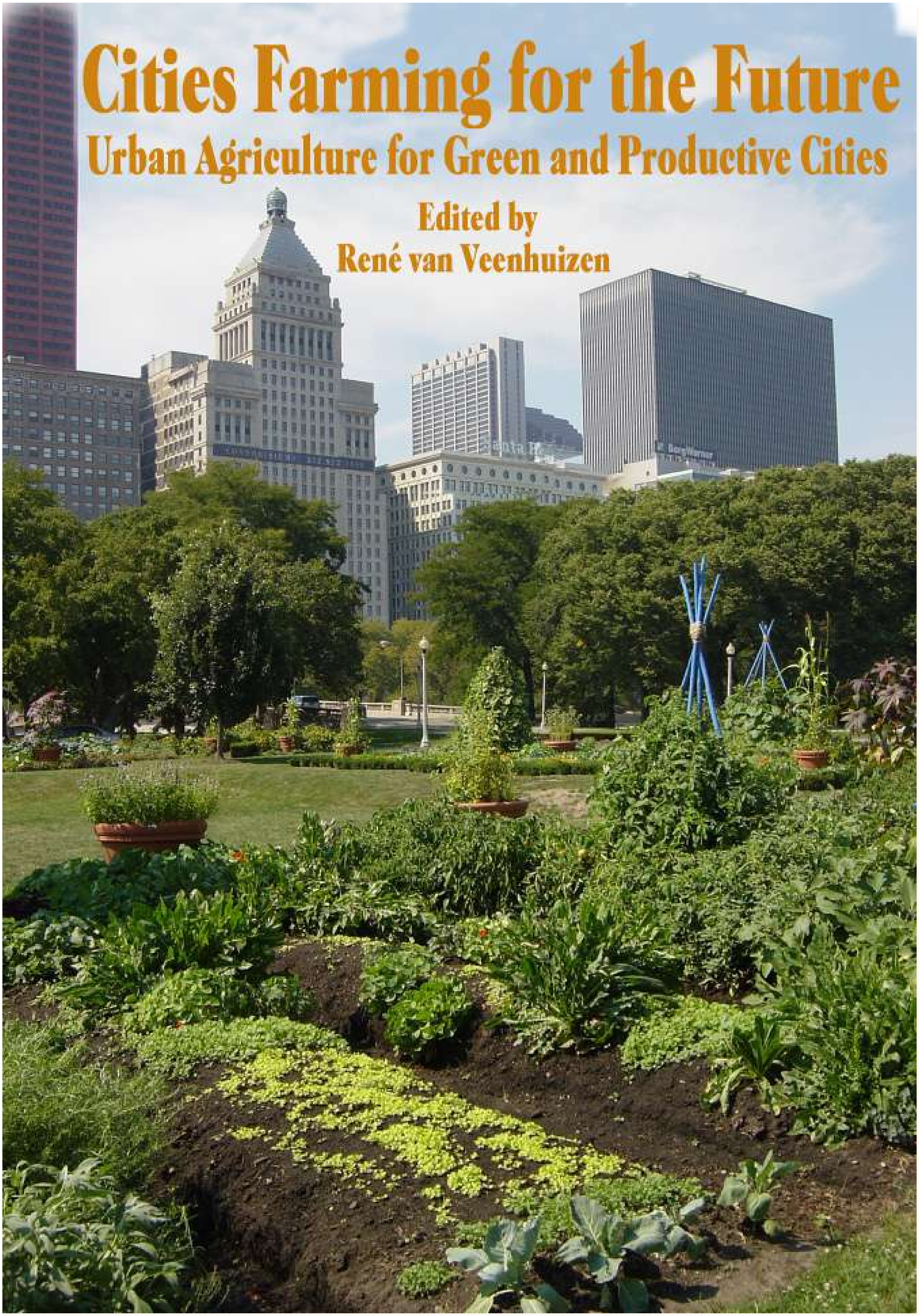
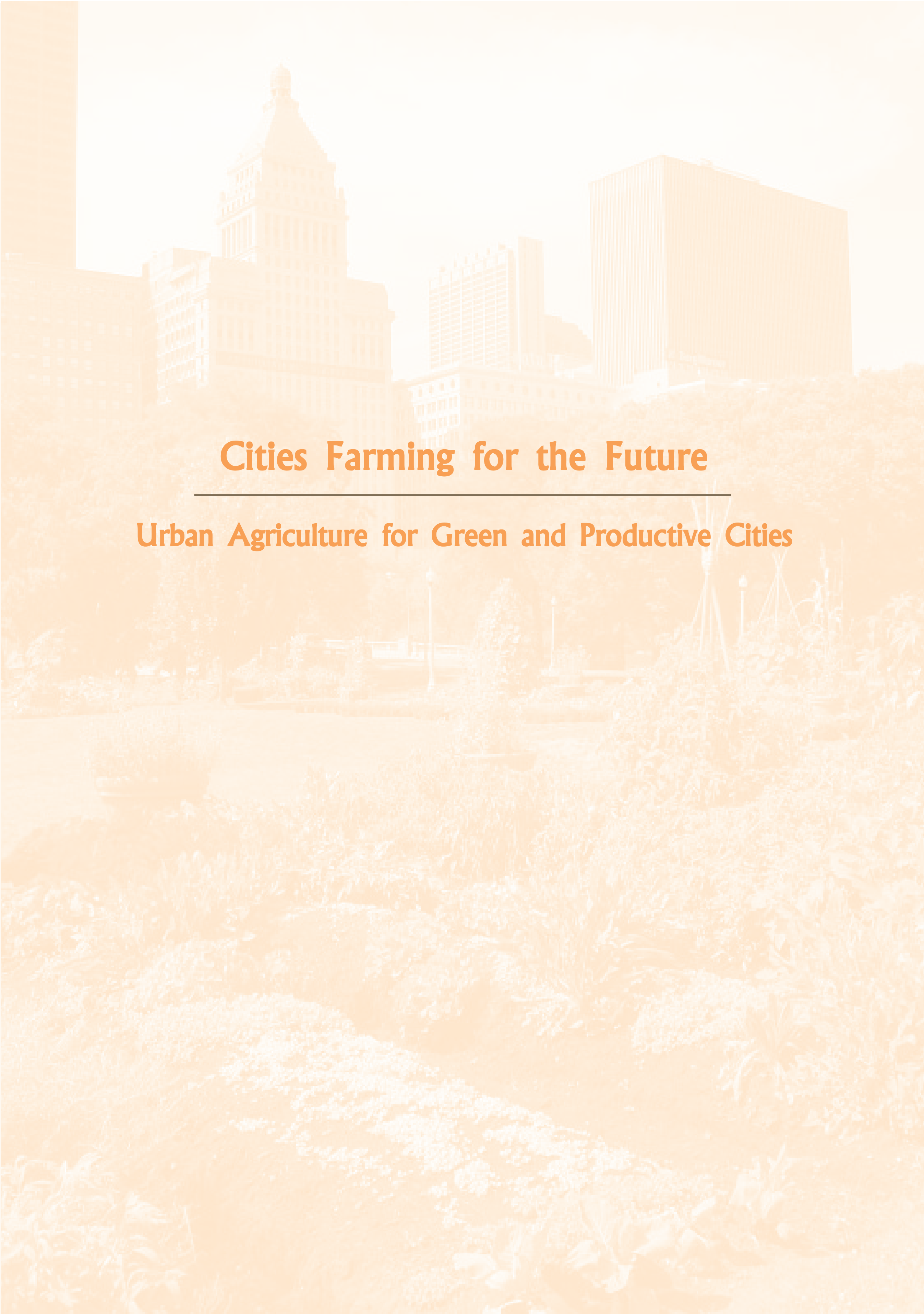
Cities Farming for the Future

Urban Agriculture for Green and Productive Cities

Edited by
René van Veenhuizen





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René van Veenhuizen
ETC – Urban Agriculture

RUAF Foundation

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Foreword

The livelihood of a large number of people in cities in developing countries, especially the poor and women, depends completely or partly on urban agriculture.

These agricultural activities take place in various parts of cities, both in the built-up area (in back yards, along streams and railway reservations, on vacant public or private land) as well as in the rapidly changing sub- and peri-urban areas.

Attention to urban agriculture is steadily increasing. Research undertaken in the last two decades indicates that urban agriculture has multiple roles and functions and plays an important role in:

- enhancing urban food security, nutrition and health;
- creating urban job opportunities and generation of income especially for urban poverty groups and provision of a social safety net for these groups;
- contributing to increased recycling of nutrients (turning urban organic wastes into a resource);
- facilitating social inclusion of disadvantaged groups and community development; and,
- urban greening and maintenance of green open spaces.

However, the potential adverse effects of urban agriculture on health (eg. the risks associated with irrigation of food crops with urban wastewater) and the environment (eg. pollution of underground water by agro-chemicals) also need to be recognised. Balancing of the positive and negative impacts that agriculture may have in a specific city, depends to a large extent on the measures taken by the local authorities to enhance the benefits of urban agriculture while reducing the associated risks.

Conventionally, city governments looked upon agriculture as incompatible with urban development and as a relict from rural-urban migration that dwindles as cities and urban economies grow. Urban agriculture was not given any policy attention, other then restricting it as much as possible or permitting it only as a temporal use of the sites concerned until urban functions took over its use.

Activities of the partners in RUAF (International network of Resource Centres on Urban Agriculture and Food Security), in cooperation with UN-Habitat/UNDP's Urban Management Programme in Latin America, IDRC's Cities Feeding People programme, FAO's PAIA Food for the Cities, CGIAR-Urban Harvest and other organisations, have demonstrated to local authorities in many countries that urban agriculture is more pervasive than ever before. These cities have recognised that agriculture and related activities form an integral part of the urban socio-economic and ecological system, link to several critical urban issues, and need proper policy attention and support. Such recognition has led to policy changes in many cities and the design of adequate programmes on urban agriculture involving various stakeholders from governmental and private sectors.

Since 1999, the RUAF partners have been playing a crucial role in improving access to information on urban agriculture of local authorities, NGOs, farmer organisations and other stakeholders, and in enhancing the capacity of such organisations to engage in local participatory processes of diagnosis and strategic action planning on urban agriculture.

This publication presents a vivid picture of the progress made since the ground breaking UNDP publication "Urban Agriculture" (published in 1996) and the DSE publication "Growing Cities, Growing Food; Urban Agriculture at the Policy Agenda" (Bakker et al., 2000).

The publication is a well-balanced combination of the experiences gained by local RUAF partners in cities in developing countries with the expertise of leading researchers in their respective thematic fields. The book's focus on policy and action orientation makes it a valuable resource for local policymakers, urban planners, organisations of urban farmers, NGOs and other stakeholders in urban agriculture. The book will enhance their understanding of the role urban agriculture can play in promoting inclusive, green and productive cities and provide ways to facilitate safe and sustainable urban agriculture.

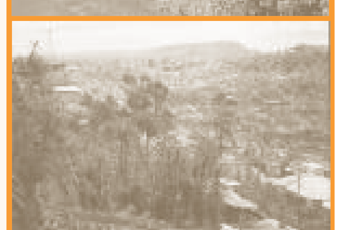
For United Nation agencies and other international donor organisations, this publication provides some important directions to consider regarding the role of urban agriculture in the context of achieving the Millennium Development Goal of halving poverty by 2015. Experiences documented in this publication provide evidence of how local authorities deal with urban agriculture in the context of food security for the urban poor. Urbanisation of poverty in the developing countries is becoming a serious concern, and international agencies need to support programmes and activities that promote development of safe and sustainable urban agriculture systems and integration of these in the urban planning system.

Dinesh Mehta
Coordinator
Urban Management Programme
UN-Habitat
May 2006

Chapter 1

Introduction
Cities Farming for the Future





Cities Farming for the Future

René van Veenhuizen

Attention to urban agriculture has increased markedly during the last couple of decades. The number of activities to promote urban agriculture at international, national and local level has grown, but urban farmers in many cities in the world still struggle to get their main survival strategy recognised by city authorities. The demand of policy makers and local practitioners for inspiring examples of successful policies and actions in cities is therefore growing. Urban agriculture contributes to a wide variety of urban issues and is increasingly being accepted and used as a tool in sustainable city development. Currently the challenge is its integration into city planning and facilitation of its multiple benefits for urban inhabitants. This book seeks to present the current state of affairs regarding urban agriculture and sustainable urban development.

Urban Agriculture

Urban agriculture can be defined as the growing of plants and the raising of animals for food and other uses within and around cities and towns, and related activities such as the production and delivery of inputs, and the processing and marketing of products. Urban Agriculture is located within or on the fringe of a city and comprises of a variety of production systems, ranging from subsistence production and processing at household level to fully commercialised agriculture.

FAO

Bosnia, a widow user a plot supplied free by the municipality

Urban agriculture is generally characterised by closeness to markets, high competition for land, limited space, use of urban resources such as organic solid wastes and wastewater, low degree of farmer organisation, mainly perishable products, high degree of specialisation, to name a few. By supplying perishable products such as vegetables, fresh milk and poultry products, urban agriculture to a large extent complements rural agriculture and increases the efficiency of national food systems.

Having reviewed the literature, Mougeot (2000) concludes that the most important distinguishing character of urban agriculture is not so much its location - or any other of aforementioned criteria - but the fact that it is an integral part of the urban economic, social and ecological system: urban agriculture uses urban resources (land, labour, urban organic wastes, water), produces for urban citizens, is strongly influenced by urban conditions (policies, competition for land, urban markets and prices) and impacts the urban system (effects on urban food security and poverty, ecological and health impacts).

Growing urban poverty, hunger and lack of formal employment, as well as the special opportunities that a city provides for farmers (including the growing urban demand for food, herbs and plants, proximity to markets and availability of cheap resources such as urban organic wastes and wastewater) have stimulated the development of a diversity of agricultural production systems in and around cities, often specialised in perishable products, such as green leafy vegetables, milk, eggs and meat, taking advantage of vacant open spaces in and around cities.

Although some forms of urban and peri-urban agriculture are based on temporary use of vacant lands, urban agriculture as such is a permanent feature of many cities in developing as well as developed countries.

Box 1.1 *Urban farming systems*

Although generalisations about urban farming systems can be made, it is difficult to make comparisons between the various farming systems in different cities, especially due to lack of data (van Veenhuizen, forthcoming).

Schiere (in chapter 12) stresses the importance of establishing locally-relevant criteria for the characterisation of locally-relevant farming systems. He argues that urban farming in and around urban areas occurs in varying forms and with various functions, while perceptions concerning the relevance and occurrence differ between stakeholders and locations.

The authors of chapters 6 and 10 of this book discuss urban livelihoods, characterising urban farmers, or farm households, in terms of their capabilities and assets. They show that a range of actions are possible and necessary, and that these actions are different from experiences in rural contexts.

Many attempts to classify urban agriculture are related to the analysis of production and (household) income level. In chapter 7 the authors summarise these different attempts in three major types of urban agriculture: subsistence urban farmers; family-type (semi-) commercial farmers; and agricultural entrepreneurs. And even though all these types of urban farming systems may have an important but different role in a given city at a certain time in development, support is specifically necessary for the first two types.

Potentials and Risks of Urban Agriculture

Urban agriculture, as with other urban activities, has both positive and negative social, environmental, and economic impacts and externalities. Externalities are transformations of the physical or social environment caused, in this case, by urban farming beyond the limits of its productive system (Fleury and Ba, 2005). The risks of urban agriculture relate to human health and the environment, if certain associated risks are not taken into account and consequently proper preventive and guiding measures are not implemented. The main potentials and risks of urban agriculture can be summarised as follows:

Urban food security and nutrition

The contribution of urban agriculture to food security and healthy nutrition is probably its most important asset. Food production in the city is in many cases a response of the urban poor to inadequate, unreliable and irregular access to food, and the lack of purchasing power. In urban settings, lack of income translates more directly into lack of food than in rural settings (cash is needed to buy food).The costs of supplying and distributing food from rural areas to urban areas, or importing food for the cities, is rising continuously, and its distribution within the cities is uneven. As a consequence, urban food insecurity will continue to increase (Argenti, 2000).

In addition to enhanced food security and nutrition of the urban producers themselves (Nugent and Bourgue 2000), urban agriculture produces large amounts of food for other categories of the population. It was estimated that 200 million urban residents produce food for the urban market providing 15 to 20 percent of the world's food (Margaret Armar-Klemesu, 2000).

Health

Improved access to fresh food as described above, directly relates to improved health. In most discussions, though, the health risks of urban agriculture are referred to in a negative context. A review of literature (Birley and Lock, 2000, Danso et al., 2003) indicates that, although insight into the potential health risks of urban agriculture is growing, detailed information on the actual health impacts of urban agriculture is still scanty (which pretty much is the case today). However, the health risks associated to urban agriculture should be taken seriously and health impacts assessments and adequate regulatory and preventive measures should be put in place. But the fear of contaminated food and other health risks should not be exaggerated and need to be compared to those of rural agriculture.

The main health risks associated with urban agriculture can be grouped into the following categories:

- Contamination of crops with pathogenic organisms as a result of irrigation with water from polluted streams and insufficiently treated wastewater or the unhygienic handling of the products during transport, processing and marketing of fresh products;
- Spread of certain human diseases by mosquitoes and scavenging animals attracted by agricultural activities;
- Contamination of crops due to prolonged intensive use of agrochemicals;
- Contamination of soils and products with heavy metals due to traffic emissions and industrial effluents;
- Certain diseases transmitted to humans by keeping livestock in close proximity without proper precautions being taken.

Local economic development

Urban agriculture is an important source of income for a substantial number of urban households. In addition to income from sales of surpluses, farming households save on household expenditure by growing their own food. Since poor people generally spend a substantial part of their income (60 – 80 percent, Mougeot, 2005) on food, the savings can be substantial (see also chapter 7). Urban agriculture also stimulates the development of micro-enterprises for the production of necessary agricultural inputs (eg. fodder, compost, and earthworms), the processing, packaging and marketing of products and the rendering of other services (eg. animal health services, bookkeeping, transportation).

Social inclusion and gender

Urban agriculture may function as an important strategy for poverty alleviation and social integration of disadvantaged groups (such as immigrants, HIV-AIDS affected households, disabled people, female-headed households with children, elderly people without pension, youngsters without a job) by integrating them more strongly into the urban network, providing them with a decent livelihood and preventing social problems (Gonzalez Novo and Murphy, 2000). The role of urban agriculture in building of communities is discussed in chapter 6. Urban and peri-urban farms may also take on an important role in providing recreational and educational functions to urban citizens or play a role in landscape and biodiversity management.

A large majority of the world's urban farmers are women (around 65 percent). Promotion of urban agriculture without due attention to gender aspects may lead to a (further) increase in women's burden of work.

Urban environmental management

The disposal of waste has become a serious problem in many cities. Urban agriculture can contribute to solving this problem by turning urban wastes into a productive resource through compost production, vermiculture, and irrigation with wastewater (see chapters 8 and 9). Urban agriculture and forestry can also have a positive impact upon the greening of the city, the improvement of the urban micro-climate (wind breaks, dust reduction, shade) and the maintenance of biodiversity (see chapter 14) as well as the reduction of the ecological foot print of the city by producing fresh foods close to the consumers and thereby reducing energy use for transport, packaging, cooling, etc. Research in the Netherlands has shown that greenery around homes has a positive effect on people's health.

However, urban agriculture could contaminate local water sources if overly high inputs of chemical fertilisers and pesticides are used (discussed in chapters 9 and 11). The wastewater discharge from intensive poultry farms for instance can be high in micro-organisms and could contaminate drinking water supplies. Inappropriate farming practices may - under certain situations - lead to reduction of vegetation or siltation of water bodies. Because of the under-valuation of urban agriculture and the stiff competition for land, urban agriculture is often pushed back to the marginal areas within a city such as wetlands and hill-slopes, where it may harm the fragile ecosystems if not properly guided.

Growing Attention for Urban Agriculture

Cuba, Argentina and Brazil (Zero Hunger Campaign) are well known examples of countries where substantial government support is given to the development of urban agriculture. Other countries such as Botswana, Zambia, Benin and China are preparing policies favourable to urban agriculture, often as part of a broader strategy (eg. Food Security Policy, Poverty Reduction Strategy, Sustainable City Development Policy or Irrigation Policy). An increasing number of city governments has or is formulating policies and programmes on urban agriculture (Rosario in Argentina, Kampala, Dar es Salaam, and Bulawayo in Zimbabwe).

This trend is also reflected in a number of "Declarations on Urban Agriculture" in which local and national level policy makers have stated their formal commitment to develop policies and programmes on urban agriculture, as was the case of the mayors present at regional meetings in Quito (2000 – see box 1.2), Dakar (2002), Addis Abeba (2003) and Beijing (2004) and the ministers present in the Regional Ministers Conference on Urban Agriculture in Southern Africa, Harare, 2003 (see chapter 3).

Box 1.2 *Quito Declaration*

At an international workshop on Urban Agriculture held in Quito, Ecuador, from 16 to 21 April 2000, *"Urban Agriculture in the Cities in the 21st Century"*, the participating mayors signed the following declaration:

"We affirm our promise to promote Urban Agriculture in our cities, with the objective to design and improve municipal policies and actions on urban agriculture, to strengthen food security, eradicate poverty, improve the environment and human health, and develop participatory governance".

"We also affirm our decision to produce and disseminate methodological tools, guides and mechanisms that collect regional experiences and inform others about the elaboration and implementation of policies and municipal interventions related to urban and land use planning; re-use of wastewater; access to credit for urban agriculture; transformation and commercialisation".

Signed by 22 countries in Latin America and the Caribbean.

The growing attention of local and national policy makers and practitioners is also reflected in the growing demand (eg. to the RUAF partners) for inspiring examples of successful policies and programmes on urban agriculture as well as for training and (co-) funding of research and action programmes.

This can be attributed to several factors among which are:

- *The fast urbanisation process and the "discovery" that both urban poverty and urban food insecurity are rapidly increasing*. The quick urbanisation process has created vast problems for urban authorities. Most cities have not been able to create sufficient employment opportunities for its population leading to a rapid development in the so-called informal sector, including urban agriculture.

- *The growing body of research data on urban agriculture and urban food security* providing data on the presence and persistence of urban agriculture in cities in the South and its importance for urban food security and income generation for the urban poor. Since the early nineties, IDRC's Cities Feeding People programme has encouraged action research on urban agriculture. In 2000, the international research organisations belonging to the Consultative Group on International Agricultural Research (CGIAR) included urban agriculture in their research agenda and initiated a group-wide research programme on urban agriculture under the name "Urban Harvest" with activities in many countries. Since then, several national research organisations have been including urban agriculture in their regular programmes (eg. in Argentina, Kenya, Senegal, and Niger).

- *The growing attention to urban agriculture and urban food security by international organisations* such as FAO, UNDP and UN-Habitat and the growing attention given to such issues at International Summits. In 1996 some 40 international organisations involved in urban agriculture created the International Support Group on Urban Agriculture (SGUA) to establish a joint agenda and to coordinate their activities. UNDP and UN-Habitat have included urban agriculture in the Urban Management Programme (Latin American section) and have been working with municipalities in the region on the integration of urban agriculture into urban policies and planning. Recently this initiative has also been taken up by the African Network of Urban Management Institutions (ANUMI, 2005). FAO has integrated urban agriculture in its agenda and created an interdepartmental working group on urban agriculture and food security (now renamed as PAIA Food for the Cities). The FAO has organised regional consultations, in Stellenbosch, Bangkok and Nairobi (the last one in cooperation with UN-Habitat, IDRC and RUAF). Special sessions and panels on urban agriculture were organised at the UN Conference on Human Settlements in Istanbul 1996, the WHO Healthy Cities Conferences in Athens 1996 and in Belfast 2002 and at the Habitat World Urban Forum Barcelona 2004, to mention a few.

- *The growing capacities at regional and local levels regarding urban agriculture.* IDRC organised regional training of trainers workshops in Senegal (1999), Quito (2001), Nairobi (2003) and Beirut (2005). Regional networks on urban agriculture have started functioning in Latin America (AGUILA), Francophone Africa (Réséau Francophone Agriculture Urbaine), the Middle East and North Africa (MENA Urban Agriculture Network) and South East Asia (Peri-urban Development in South East Asia - PUDSEA). RUAF has established regional resource centres on urban agriculture and food security that have been very instrumental in pooling and disseminating the growing body of knowledge on urban agriculture and facilitating networking and capacity development at regional and city levels.

As a result of such developments, as well as the pressure by local poverty groups, urban farmers and NGOs, many city authorities have acknowledged the potential of urban agriculture and are collaborating with other local stakeholders in efforts to maximise the benefits of urban agriculture while reducing the associated risks.

Box 1.3 *Urban Agriculture and the Millennium Development Goals*

The Millennium Development Goals (MDGs), which are agreed upon by member states of the United Nations, constitute an agenda for reducing poverty and improving livelihoods. They call for a concerted effort to find solutions to hunger, malnutrition and disease by reducing by half the number of people who suffer from hunger between 1990 and 2015. Eight Goals and 18 specific development targets, each with its own set of indicators have been agreed on (See www.unhabitat.org).

Urban agriculture is an important (complementary) strategy to achieve MDG 1 (Eradicate extreme poverty and hunger) as well as MDG 3 (Promote gender equality and empower women), MDG 6 (Combat HIV-AIDS and other diseases) and MDG 7 (Ensure environmental sustainability).

See for an extensive discussion: Mougeot, 2005.

City Dynamics; the context for urban agriculture

Rapid Urbanisation

The number of people around the world who live in and around cities is increasing steadily. The "State of the World Cities" by UN- Habitat (2004) predicts that by 2030, 60 percent of the world's population will live in cities. The growth of cities is due to the natural growth of the urban population and to migration from the rural areas to the cities, with the former gradually becoming more important than the latter (Drescher and Iaquinta, 1999). There is general consensus that urban populations will continue to grow rapidly in most developing countries in the decades to come.

Bert Lof

Chicago Grant Park ; combining food production, leisure and architecture.

The extent of urbanisation varies by region (UN-Habitat, 2004). Latin America, which is the most urbanised region in the developing world, has more than 75 percent, or 391 million, of its people living in cities and the urban population in the region will approach 539 million, or 81 percent of its projected total population of 665 million, by 2020. With the exception of Brazil, the urbanisation pattern in most countries in the region typically involves one very large city that accounts for much of the country's urban population. In 2005, sub-Saharan Africa's urban areas accounted for 34 percent of the total population of 611 million, which will approach 440 million, or 46 percent of its projected total of 952 million, by the year 2020. Global economic processes have stalled in sub-Saharan Africa, while the urban population is quickly growing, causing severe consequences for the livelihoods of people in urban areas. In Asia and the Pacific, urban areas today account for 35 percent of the total population of 3,515 million, and is expected to grow to 1,970 million or 46 percent in the next 15 years. An increasing number of the region's poor live in urban areas.

Increasing urban poverty and food insecurity

Many cities cannot cope with such massive population growth. City authorities around the world face enormous challenges in creating sufficient employment, in providing basic services such as drinking water, sanitation, basic health services and education, in planning and maintaining of green spaces, in managing urban wastes and waste water and in decentralisation and creation of efficient local autonomy.

The increase in urban poverty is accompanying the urbanisation process and poverty is concentrating gradually in the urban areas ("urbanization of poverty", Baud, 2000). A massive 40 percent of the population of Mexico City, for instance, and a third of Sao Paulo's population is at or below the poverty line. According to UN-HABITAT, slum populations in urban areas of developing countries were estimated at 870 million in 2001 and are expected to increase by an average of 29 million per year up to 2020.


Le Thanh Hung

Water mimosa culture in Binh Chanh district, Ho Chi Minh City

Growing urban poverty goes hand in hand with growing food insecurity and malnutrition in the urban areas. Both in the South and in the North, especially in the bigger cities, the urban poor find it increasingly difficult to access food. Food composes a substantial part of urban household expenditures (60-80 percent for poor households) and the lack of cash income translates more directly into food shortages and malnutrition (Mougeot, 2005) in the city context.

This indicates that cities are quickly becoming the principal territories for intervention and planning of strategies that aim to eradicate hunger and poverty and improve livelihoods, requiring innovative ways to stimulate local economic development in combination with enhancing food security and nutrition. Urban agriculture is one such strategy.

Urban sprawl

Rapid urbanisation leads to a continuous extension of the city into the rural suburbs, bringing large areas under the direct influence of the urban centres. Around cities there are dynamic and expanding zones of interaction between urban and rural areas. This peri-urban interface (Brook and Dávila, 2000) is characterised by rapid land use changes and changing livelihoods. The traditional local agricultural and land distribution system is disrupted by urban newcomers seeking to buy land (for speculation, for mining of loam, sand and stones, for infrastructure development, for construction, for more urbanised types of agriculture) leading to an increase of land prices. In response, some of the traditional farmers are giving up farming, selling their land and switching to other income earning activities; in other households the males (mainly) are engaging in urban jobs while the females take main responsibility for the farming operations; yet another part of the (now) peri-urban farmers are starting to intensify their farming systems and to adapt to the new more urban conditions (change of crops, market orientation, use of new technologies such as production under covers, direct marketing, use of urban organic wastes or wastewater etc.). The interdependence between urban and surrounding rural areas creates the need for integrated development approaches (Purushothaman and Brook, 2004), which calls for rethinking domains of interest, institutional change and innovative planning approaches.

City renewal

Cities are in a constant process of building and decay. Existing open spaces get built up, and the formal or informal temporary users of such areas are removed (as is regularly happening to many urban farmers who are forced to find an alternative location or give up farming). Meanwhile, degenerated residential, office or industrial areas are demolished, creating new open spaces that may stay vacant for a long time until a new purpose and the corresponding investments are found. New roads and power lines continue to be constructed, creating new vacant open spaces as reservations for these structures. Often such newly created open spaces are gradually occupied by urban producers (informally or through temporary leases). Urban agriculture can therefore be characterised as a form of "shifting cultivation" - although it is a permanent element of the urban system, its locations within the city may vary over time.

Other city dynamics

Other city dynamics that directly influence the development of urban agriculture, and how and where it is practised, are urban traffic and industry (negatively influencing the quality of soils and irrigation water), new demands from urban citizens (need for recreational spaces, new products), changes in urban zoning and related norms and regulations, changes in the urban labour market etc.

These city dynamics take place in a world which is opening up and becoming more global, but at the same time is seeking a more local focus, decentralisation and maintenance of local socio-cultural identity (Baud, 2000). Both tendencies influence urban agriculture; globalisation leads to new products entering the market, more information available in general, and changing consumer preferences and thus leading to increased buying in super markets; the local focus trend leads to preferences for locally-grown fresh foods and direct producer-consumer linkages (see for instance box 1.6 and chapter 6 in this volume).

Development of Urban Agriculture in Response to Urban Dynamics

Urban agriculture has always been part of city life. It has never ceased to exist, but it has adapted to changing situations. Urban citizens develop many different strategies to improve their livelihoods and urban agriculture is one of them. Urban agriculture is responding in three main ways to these urban dynamics (van Veenhuizen, 2006 forthcoming).

The first is the response of the urban poor and unemployed to urban poverty and food insecurity/malnutrition. Sometimes this is due to a temporary crisis situation such as a natural disaster (Mitch in Honduras, drought in Bolivia), a temporary economic crisis (Russia after the transition to capitalism), a war (East-Congo) or an epidemic (Malawi). However, many of these urban poverty and hunger problems have become structural and current trends show that urban agriculture will have a longer term role as a social security net for poor and disadvantaged urban households.

IGSNRR

Si ji qing Cherry-picking plantation: agro-tourism in Beijing, China

The second is as a response of the urban poor as well as people from other social classes to the opportunities and relative advantages that the urban environment provides for agricultural producers: direct access to urban consumers and markets, availability of cheap inputs such as urban organic wastes and wastewater, closeness to institutions that provide market information, credit and technical advice, new urban demands etc.

The third adaptation of urban agriculture is a direct response of urban farmers to conducive urban policies and programmes, stimulating and enabling urban agriculture to fulfil certain functions required for sustainable city development: local economic development and food supply as well as recycling of wastes, urban greening, maintaining open green buffer zones, provision of recreational services, mitigation of HIV-AIDS, social inclusion of disadvantaged groups etc.

It is no surprise then, that agriculture within cities can have many different functions. Some of the functions of agriculture can be valued in monetary terms while with others this is hardly possible (aesthetical or sentimental values). The sustainability of urban agriculture is related to this multi-functionality. Urban agriculture adapts and develops along with the city according to the wishes of stakeholders who represent these diverse functions. Therefore, new forms of governance, institutions, and policies need to be crafted through processes that seek synergies and involve multiple stakeholders (van de Berg and van Veenhuizen, 2005).

Policy Making and Action Planning on Urban Agriculture

When local authorities come to understand the role urban farmers can play in various urban policy areas rather than just prohibit or (temporarily) tolerate urban agriculture, they will seek to formulate policies that facilitate and regulate urban agriculture so as to maximise the benefits of urban agriculture whilst preventing or reducing the associated risks.

Urban agriculture has a significant share in the food supply of many cities in the world, supplying especially perishable products such as vegetables, fresh milk and poultry products, but important differences are found between urban and rural agriculture. This has important consequences for the design of policies and support programmes.

Policy dimensions of urban agriculture

Dubbeling (2005) and Cabannes (2004, see also chapter 4 in this book) describe three main policy dimensions of urban agriculture that may help to focus and differentiate policies regarding urban agriculture (they are shown in an adapted form in figure 1.1).

A first, the *social* policy dimension refers mainly (but not exclusively) to *subsistence oriented* types of urban agriculture that form part of the livelihood strategies of (especially) the urban poor and that are mainly focused on producing food and medicinal plants for home consumption. In addition, the expenses of the family on food and medicines are reduced and minor cash income is generated from sales of surpluses. These households need additional income from other sources than agriculture to survive. Examples include home gardening, community gardening, institutional gardens at schools and hospitals, and open field farming at micro scale with low levels of investment. These systems show little direct profitability but have important social impacts such as social inclusion, poverty alleviation, community development, HIV-AIDS mitigation etc.

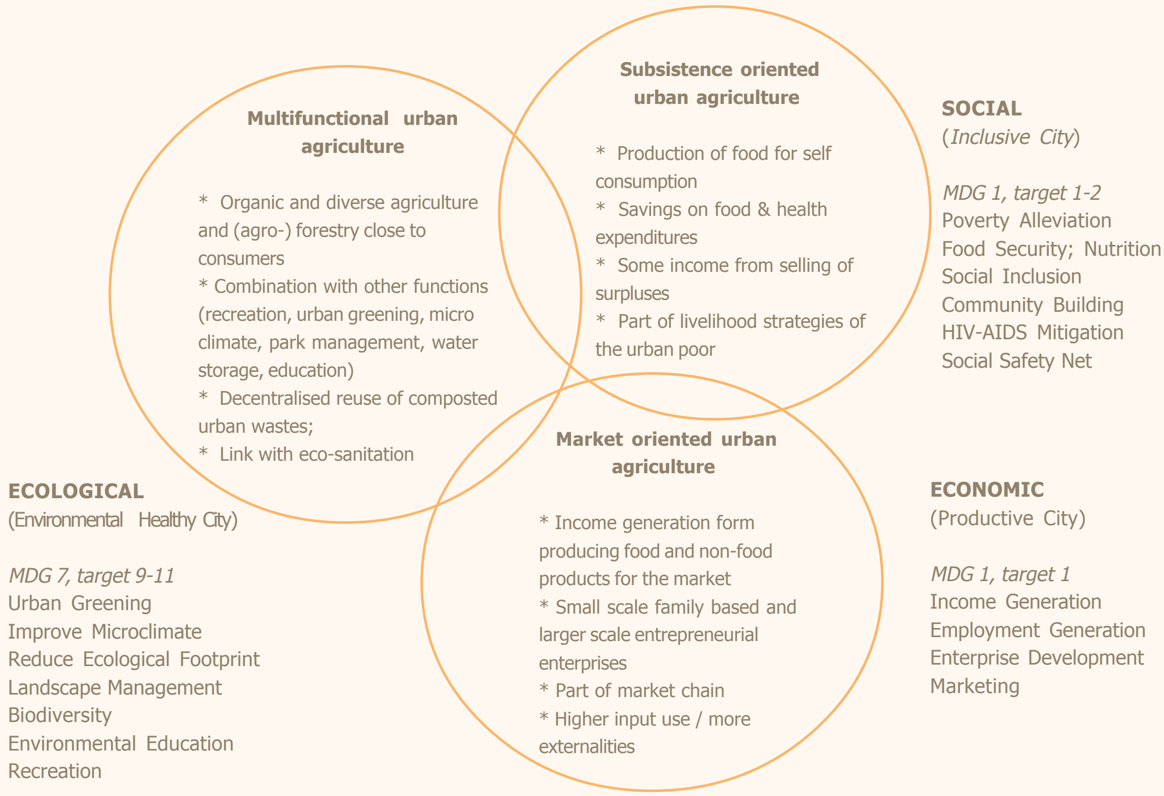
Kate Casale

Hydroponics at Espacio Verde, in Buenos Aires

The e*conomic* policy dimension is more related to *market oriented* types of urban agriculture. Activities are undertaken (mainly) by small-scale family-based enterprises and (some) larger scale entrepreneurial farms run by private investors or producer associations. The activities not only refer to food production (eg. irrigated vegetable production, stall-fed dairy production) but also to non-food products (medicinal and aromatic herbs, flowers, ornamental plants). These commercial farms are embedded in a chain of small-scale and larger enterprises involved in inputs delivery (eg. compost, fodder), processing and marketing.

These types of urban agriculture have more economic impact and higher profitability, but their externalities for the city and urban populations, especially those of the intensive larger scale enterprises, tend to be higher (eg. risk of contamination of soils and water due to intensive use of agro chemicals, health risks due to use of contaminated water for irrigation and risks of zoonosis).

Figure 1.1 *Policy dimensions and main types of urban farming*



In: van Veenhuizen (forthcoming), based on Cabannes and Dubbeling (2005)

The e*cological* policy dimension refers to types of urban agriculture that have a *multi-functional* character: besides provision of food and generating income they play a role in environmental management and provide other services demanded by urban citizens: decentralised composting and reuse of organic wastes and wastewater (including nutrients), urban greening and improvement of the urban climate (shade, O_2, dust reduction), landscape management (parks, buffer zones, flood or earthquake prone or ecologically valuable zones that should be kept free from construction), provision of opportunities for leisure and recreational activities, water storage etc. In order to allow such a combination of functions, multi-functional agriculture will have to adopt agro-ecological production methods, link up with eco-sanitation and decentralised sustainable waste management, as well as with parks, nature and recreation planning and management.

The analysis of the actual urban farming systems and the discussion of alternative policy measures could be directly linked with one or more of the above mentioned policy areas, depending upon the actual situation in the city and the existing policy priorities. A local government concerned about the growing food insecurity or the exclusion of certain categories of the population will probably focus on the "social" dimension of urban agriculture. Another city - mainly interested in local economic development- will focus on the "economic" dimension of urban agriculture or seek to stimulate subsistence farmers to move into the market sector. Local authorities mainly concerned about the poor urban living climate, the growing waste management problems, or the negative environmental and health effects of market-oriented urban agriculture, may concentrate on the 'environmental' dimension of urban agriculture, or promote a shift from high-input commercial agricultural production towards sustainable and multi-functional agriculture.

Multi-actor policy development and action planning

Due to the cross cutting and multi-functional nature of urban agriculture, policy development and action planning on urban agriculture should involve various sectors and disciplines: agriculture, health, waste management, community development, parks and nature management, among others.

Moreover, urban farmers, and the CBOs and NGOs supporting them, have to be involved in the planning process. According to Allen (2001) the most important aspect of strategic urban planning is related to the participation of the urban poor themselves in the analysis of the situation, in the definition of priorities and in action planning and implementation. Such consultative processes will make the outcomes of policy development and action planning not only robust and comprehensive, but also accepted and sustainable. Increasingly this is recognised and incorporated in urban planning approaches such as the multi-actor planning methodologies adopted by Local Agenda 21 and the Sustainable Cities Programme (see for a more extensive list, chapter 3).

Box 1.4 *Multi-stakeholder Policy making and Action Planning on urban agriculture*

Multi-stakeholder planning processes on urban agriculture have been, amongst others, applied by Urban Management Programmes in Quito-Ecuador, Rosario-Argentina and Dar Es Salaam-Tanzania. Similar approaches have been used in promoting sustainable food systems through Food Policy Councils (Toronto, Chicago and Vancouver-Canada). The Multi-stakeholder Policy making and Action Planning (MPAP) approach that is used by the RUAF partners in the Cities Farming for the Future programme is described in chapter 2 of this volume (see also www.ruaf.org).

In most cases a platform on urban agriculture or urban food policy is established, involving all direct and indirect stakeholders in urban food production and consumption, assisted by one or more working groups. This multi-stakeholder forum functions as a platform for dialogue and consensus building among the various stakeholders regarding the following: problem definition, agenda setting and identification of priorities; making choices among alternative strategies and policy instruments available; coordination of the drafting of action plans and participatory budgeting; coordination of the implementation and the results obtained; drawing lessons and adjustment of strategies.

Strategies for the development of safe and sustainable urban agriculture

Although urban agriculture takes place under varying socio-political conditions and policy regimes urban policy makers and support institutions can substantially contribute to the development of safe and sustainable urban agriculture by:

- Creating a conducive policy environment and formal acceptance of urban agriculture as an urban land use;
- Enhancing access to vacant open urban spaces and the security of agricultural land use;
- Enhancing the productivity and economic viability of urban agriculture by improving access of urban farmers to training, technical advice, and credit;

- Supporting the establishment and strengthening of urban farmer organisations;
- Taking measures that prevent/reduce health and environmental risks associated with urban agriculture (farmer training on health risks and related management practices, zonification, quality control of irrigation water and products).

Creation of an enabling policy environment
Formal acceptance of urban agriculture as an urban land use and integration into urban development and land use plans is a crucial step towards effective regulation and facilitation of the development of urban agriculture. Existing policies and by-laws regarding urban agriculture will have to be reviewed in order to identify and remove unsubstantiated legal restrictions and to integrate more adequate measures to effectively stimulate and regulate the development of sustainable urban agriculture.

A second important step is the creation of an institutional home for urban agriculture. Conventionally, sector policies have been defined under the assumption that agriculture refers to the rural sphere and will be attended to by institutions other than the urban ones, whilst most agricultural organisations do not operate in the urban sphere (Tacoli, 2001). As a consequence, urban agriculture is receiving little policy and planning attention and development support.

Municipal authorities can play a key role in filling this gap, for instance by selecting a leading institute in the field of urban agriculture with an urban agriculture office or department, and by establishing an interdepartmental committee on urban food production and consumption. Also important is stimulating the dialogue and co-operation among the direct and indirect stakeholders in urban agriculture. This can be done by setting up a multi-actor platform and working group on urban agriculture that organises the joint analysis of the presence, role, problems and development perspectives of urban agriculture in the city and coordinates the process of interactive formulation of policies and the planning and implementation of action programmes by the various actors.

Enhancing access to vacant land
Land is a very important resource for urban agriculture, and its availability, accessibility and suitability are of particular concern to urban farmers.

Contrary to the common belief even in highly urbanised areas surprisingly high amounts of vacant land can be found that could be used for agriculture on a temporary or permanent basis. City governments may facilitate access of urban farmers to available urban open spaces in various ways. Box 1.5 provides examples of measures taken by various cities in the South to enhance access of poor urban farmers to land (see also the proceedings of the RUAF-Habitat E-conference "Optimising Agricultural Land Use in the City, 2003 at www.ruaf.org).

Enhancing the productivity and economic viability of urban agriculture
The productivity and economic viability of the various urban farming systems can be substantially enhanced. Agricultural research and extension organisations and other support organisations (i.e. credit institutions) have - until recently - given relatively little attention to agriculture in the urban environment. And where it has happened, most attention has been focused on the larger scale, more capital intensive and fully commercial farmers, especially peri-urban irrigated vegetable production, poultry and dairy production and aquaculture. Consequently, the potential for improvement of the efficiency in urban farming, which tends to be highly dynamic, but normally restrained due to urban farmers' limited access to training and extension services, is vast.

Governmental organisations and the private sector should be stimulated to provide training, technical advice and extension services to urban farmers, with a strong emphasis on ecological

Box 1.5 *Facilitating access to land for urban agriculture*

a. Making an inventory of the available vacant open land in the city (through participatory methods and GIS) and analysing its suitability for use in agriculture (as in Cienfuegos, Cuba; Piura, Peru; Dar es Salaam, Tanzania).
b. Creating a Municipal Agricultural Land Bank which brings those in need of agricultural land in contact with landowners in need of temporary or permanent users (as in Rosario, Argentina).
c. Stimulating owners of open vacant land (including institutional owners) to give this land on medium-term lease to organised farmer groups, by providing a tax reduction to land owners that do so (as in Rosario, Argentina) or by levying municipal taxes on land laying idle.
d. Formulating a City Ordinance that regulates the (temporary) use of vacant land in the city (as in Cagayan de Oro, the Philippines)
e. Providing of vacant municipal land to organised groups of urban farmers (as in Cagayan de Oro, Lima, Peru)
f. Taking measures to improve the suitability of available tracts of land, eg. by removing debris or providing access to irrigation water
g. Demarcating zones for urban agriculture as a form of permanent land use and integrating these into city land use planning (as in e.g. Dar es Salaam, Tanzania; Kathmandu, Nepal). Such zones normally are more sustainable if located in areas that are not well suited for construction or where construction is not desirable, as on flood plains, under power lines, in parks or in nature conservation areas. Effective guidelines are developed with active farmer participation regarding the management practices to be adopted by urban agriculture in the various locations (eg. the consultative workshops held in Rosario, Argentina and Kampala, Uganda).
h. Providing assistance to reallocate urban farmers, especially urban farmers who ar poorly located and therefore may have serious health and/or environmental risks due to these locations.
i. Including space for individual or community gardens in new public housing projects and slum upgrading schemes.

farming practices, proper management of health risks, farm development (eg. intensification and diversification), enterprise management and marketing. Cost-sharing systems (farmers, municipality, sectoral organisations, private enterprise) will be needed to ensure sustainability of the extension system.

Most urban farmers are poorly organised, and if so not in a formal way, and thus lack channels and power to voice their needs. This limits the representation of their interests in urban policymaking and planning at the various levels and hampers their participation in development programmes. Well functioning farmer organisations can negotiate access to land, adequate tenure arrangements and access to credit. Such organisations may also take up roles in farmer training and extension, infrastructure development, processing and marketing; and control / certification of the quality of the products marketed. More research is needed to identify existing farmer organisations and informal networks of (various types of) urban farmers, and to analyse their problems and needs and effective ways to further develop these organisations. Municipalities may also stimulate Universities, NGO's and CBO's present in the City to actively support farmer organisation and capacity development and their linkages with other urban farmer groups, private enterprises, consumer organisations and support organisations.

Adapted research and technology development activities jointly with urban farmers would have to be undertaken to solve current problems and to realise existing potential (see chapter 10). Urban agriculture is performed under specific conditions that require technologies different to those used in the rural context. Such specific conditions include among others: limited availability of space and the high price of urban land, proximity to large numbers of people (and thus a need for safe production methods), use of urban resources (organic waste and wastewater), and possibilities for direct producer-consumer contacts. Most available agricultural technologies need adaptation for use in these conditions whilst new technologies have to be developed to respond to specific urban needs (eg. non-soil production technologies for use on roofs and in cellars; development of safe and economic practices for reuse of wastewater).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Maize on steep slopes in Quito, Ecuador

Municipalities and other local stakeholders could voice research and technology development needs of their urban farmers to research institutes and national governments. Also more coordination between research institutes, agricultural extension organisations, NGOs and groups of urban farmers could be promoted.

Other important areas of intervention to enhance the productivity and economic viability of urban agriculture include:

- Enhancing access to inputs (eg. urban organic wastes and irrigation water) and facilitating decentralised production of such resources (eg. establishment of low-cost facilities for sorting of organic wastes and production of compost, animal feed or biogas; implementation of pilot projects with decentralised collection and treatment of household wastewater with a view on its re-use in local agricultural production); technical and financial support (eg tax reductions) for enterprises producing ecologically-friendly inputs such as natural fertilisers, bio-pesticides, soil amendments, open pollinated seeds etc..
- Enhancing the access of urban farmers to credit facilities.
- Facilitating (direct-) marketing by urban farmers: access to existing city markets, creation of farmers' markets, linking farmer and consumer organisations, use of urban farmers in supplying food for school feeding, HIV-AIDS and other food distribution programmes, and support to the creation of local infrastructure for small-scale food preservation and storage facilities (i.e., canning, bottling, pickling, drying, smoking).

Box 1.6 *Localised food systems*

Migration in Europe and North America saw its peak in the early part of the last century, leading to large cities where currently on average 75 percent of the total population seek to make a living. Many of these cities face problems of international migration or impoverishment due to industries being re-located to countries where labour is cheap. This opens new demands and changing roles for urban agriculture. In many of these cities a counter trend of localising a part of the agricultural and food production is appearing, after a decades-old path of industrialisation and globalisation. This locally based food production or "civic agriculture" (Lyson, 2004) is characterised by its multi-functionality and community linkages. The food system operates within and is influenced by the urban social, economic and natural environment. The food system can be visualised at household, community and city level and relates production, processing and marketing of food produced in urban agriculture with food stemming from other channels (rural areas, imports) and their linkages and relative contributions to the health and nutrition of the population and their contributions to the local economy and environment. In this way strategies for the development of (certain types of) urban agriculture can be focused to the strengthening of the urban food systems, complementing other components of the urban food system.

Measures to reduce the health and environmental risks associated with urban agriculture
Rather than restricting urban agriculture out of fear - often unspecified – of health and environmental risks associated with urban agriculture, cities could instead design a series of accompanying measures to reduce these risks. The most important measure is to create mechanisms of close cooperation between agriculture, health and environment/waste management departments to assess actual health and environmental risks associated with urban agriculture and to design effective preventive/mitigating strategies for which the participation of all these sectors is required.

The following measures appear regularly as part of such strategies:

- Zonification and development of adequate norms and regulations are defined: zones where certain types of urban agriculture are allowed (under certain management conditions) and others are excluded, taking into account the population density and the ecological sensitivity of the area concerned.
- Promotion of waste water treatment at source and separation of industrial and municipal wastewater streams to reduce risks of contamination with heavy metals.
- Farmer education on the management of health risks: proper choice of crops and irrigation methods, hygiene, and management of animal wastes.
- Promotion of ecological farming methods to reduce risks related to intensive use of agrochemicals.
- Consumer education regarding washing of crops and heating of milk and meat products.

Cities Farming for the Future

A growing number of cities are designing policies and programmes on urban agriculture, applying multi-stakeholder planning approaches to identify effective ways to integrate urban agriculture into urban sector policies and urban land use planning and to facilitate the development of safe and sustainable urban agriculture. These aim at fostering the multiple functions of urban agriculture. There is a need however to explore the relationship between multi-functionality and sustainability of urban agriculture.

This involves the analysis of both positive and negative environmental functions as well as their compound effect. Areas for further research and development include: land tenure, legislation and urban land use planning; gender; methodologies in working with stakeholders, such as action research with urban farmers or with planners to include agriculture in environmental planning, as a part of green belts, city parks and open spaces; development of new institutions or institutional arrangements such as urban and peri-urban markets and support to (commercial and subsistence) horticulture, aquaculture and livestock systems.

Facilitating such research and development requires the creation of adequate institutional frameworks that give urban agriculture an institutional home and ensure the active participation of direct and indirect stakeholders in the formulation and implementation of urban agriculture policies and action programmes.

When accepted and facilitated, urban agriculture will be sustainable, maintaining its dynamism and flexibility, adapting to changing urban conditions and demands, intensifying its productivity and diversifying its functions for the city, whilst reducing associated health and environmental risks and by doing so gaining more social and political acceptability. In certain parts of a city, the existing forms of urban agriculture may fade away or change its form and functions drastically, while new forms of urban agriculture may develop in other parts of that same city.

On the longer term, urban agriculture will be sustainable especially if its potential for multi-functional land use is recognised and fully developed. The sustainability of urban agriculture is strongly related to its contributions to the development of a sustainable city: an inclusive, food-secure, productive and environmentally-healthy city.

This book is a contribution to this discussion by the RUAF partners and those who have collaborated with RUAF or contributed with their experiences to the Urban Agriculture Magazine and related media. This network will continue its work in the next four years and regularly report on its experiences and new findings.

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Chapter 2

Sustaining Urban Agriculture Requires the Involvement of Multiple Stakeholders

Urban agriculture relates to a variety of urban issues, like urban poverty, land use planning, waste management, food securiy, economic development, public health, and community development. Many stakeholders can be identified who play a role and who (should) have a say in planning and development of urban agriculture and related activities, like input provision, vegetable production, aquaculture, livestock production, processing and marketing. To increase the contribution of urban agriculture to sustainable urban development requires involvement in planning and policy making of these different stakeholders. Multi-stakeholder processes dealing with urban agriculture are of recent nature. The lessons learned in the International Network of Resource Centres on Urban Agriculture and Food security (RUAF) are described.

Sustaining Urban Agriculture Requires the Involvement of Multiple Stakeholders

Marielle Dubbeling
Gunther Merzthal

Introduction

Urban Agriculture is a dynamic concept that comprises a variety of production (ranging from subsistence production at household level to fully commercialised agriculture), processing and marketing systems of food and non-food products. It takes place within heterogeneous resource situations, e.g. under scarce as well as abundant land and / or water resource situations, and under a range of policy environments that can be prohibitive or supportive to its existence and development.

Urban agriculture (UA) has been promoted over the last couple of years by a large number of local and national governments, urban actors and international agencies, such as UN-HABITAT's Urban Management Programme, FAO, International Development Research Centre (IDRC- Canada), CGIAR-Urban Harvest and the International Network of Resource Centres on Urban Agriculture and Food Security (RUAF) as a strategy to promote food security and poverty reduction, sustainable resource use and environmental management, social integration and local participatory governance (see Chapter 1).


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Community member in Governador Valadares drawing a plot diagramme, as part of an Participatroy Rapid Appraisal on urban agriculture.

Urban agriculture takes place in a multi-sectoral environment, touches on a large number of urban management areas (eg. land use planning, environmental and waste management, economic development, public health, social and community development), and involves a large diversity of systems and related actors (input provision, vegetable production, aquaculture, livestock production, processing and marketing). UA can thus be seen as a cross-cutting issue involving a wide range of often disconnected actors or stakeholders[1] needed for effective implementation, policy making and monitoring.

Increasing the contribution of UA in more sustainable urban development requires its inclusion into policy and planning and the involvement of different stakeholders related to UA (urban producers and their organisations, NGOs and researchers, private organisations and different levels and departments of governments) in these processes.

Integrating Urban Agriculture into policies and planning

Traditionally, urban agriculture met a lot of resistance by urban authorities and planners, who saw UA – due to an urban and often elite bias - as a relict of rural activities that would pass away with the growth of the city, or just as a nuisance and a health hazard. Most urban policies in developing countries give little attention to UA and tend to prohibit or severely restrict it. Agriculture is usually not considered within urban land use and development plans. Also, agricultural research, extension and credit institutions with their focus on rural areas tend not to attend to urban farmers, while their urban counterparts generally do not consider agriculture as an urban enterprise.

The challenge for much of UA practised by the urban poor and others is for it to become a social, economic as well as environmental benefit rather than a liability, and to be seen in this light by the authorities. Because poor urban producers often operate illegally, on marginal and often hazardous sites, with limited means and assistance, their practices are often unsustainable, and in some situations pose risks to their own health, that of their family and consumers.

Recognising and legalising UA as a legitimate urban land use is a crucial first step. Technical assistance and training to urban producers is essential to promote more sustainable production, processing and marketing techniques (see also Chapters 11, 12 and 13). Potential health risks, for example related to the use of agrochemicals, non-treated organic waste and wastewater, and lack of hygiene in food processing and marketing activities, need to be managed and regulated. Providing urban farmers with more secure access to land (see further Chapter 3) and water sources, as well as to services and capital (see further Chapter 4) are also important in this respect (Dubbeling and Santandreu, 2003).

A sustainable approach to UA focuses on maximising its potential social, environmental and economic contributions - contributions that, as also highlighted in Chapter 1, include the promotion of health and nutrition, ecological responsibility, social inclusion and community capacity building. In this way, one of the key policy objectives for urban agriculture is its integration into broader urban development agendas, for example related to children's and youth programmes, environmental programmes, social welfare programmes and housing and urban development programmes, as illustrated by the case of Vancouver (see at end of this Chapter). Benefits include capitalising on existing momentum, infrastructure and expertise; promoting collaboration between municipal departments; and enabling inter-connected social, economic and ecological benefits for citizens (Mendes, 2005).

Dynamic planning must provide for UA land uses to evolve as the city expands and transforms itself. Space-limited and capital intensive forms of UA (fruit trees, medicinal and ornamental plants, silk worms, mushrooms, catfish, small stall-fed livestock) can thrive in a city's core, while more land-intensive and waste-generating forms of UA could relocate to outer-lying and less populated locations (Mougeot, 2005). In order to match the demands of urban growth with activities of high economic and social value, urban agriculture should be included as a multi-functional component in municipal land use planning, zoning, master plans and neighbourhood development plans (Cabannes, 2003), as will be further discussed in Chapter 3.

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Mayor of Quito signing inter-actor agreement on UA

Involving multiple stakeholders in project development, policy and planning

The number and composition of stakeholders directly or indirectly involved in UA differ from city to city, but include:

- different levels of government (national, provincial and local governments),
- relevant municipal departments and professionals (e.g. Parks and Gardens, Health Department and inspectors, Public Works, Urban Planning Department, Water boards, Departments for community development etc.),
- local leaders and village councils,
- the private sector,
- academic organisations or research institutes,

- non-governmental organisations, social movements, grassroots and religious organisations, and
- male and female producers and their organisations, who are directly involved in agricultural production and related processing and marketing activities (farmers; local producers of inputs such as grass, compost, equipment; transporters; processors; vendors on streets and local markets).
- male and female producers and their organisations, who are directly involved in agricultural production and related processing and marketing activities (farmers; local producers of inputs such as grass, compost, equipment; transporters; processors; vendors on streets and local markets).

To be effective, project, policy and planning processes on UA should address the needs and priorities of the different stakeholders involved, as well as the specific socio-economic and political-institutional context in each locality. In the Netherlands, for example, independent water boards have a key role to play in water management. Any decision to combine a productive function of urban agriculture or aquaculture with water storage, recreation or a natural park would require agreement between, amongst others, the water board, the province and the municipality (Deelstra, et al, 2001: see the Delft case study).

Effort has to taken in identifying the different stakeholders involved (see further stakeholder inventory described below) and motivating them to participate in project development, policy and planning. Such a multi-stakeholder approach has in principle - and compared to other approaches - the following benefits:

- it allows for better quality decision finding and making (through better understanding of priority issues and needs of different stakeholders involved),
- it improves the likelihood of implementation (through enhanced ownership, improved mechanisms and processes for coordination, and more effective use of available human, technical and financial resources), and
- it gives to the process (and its results) a higher credibility, as well as wider outreach (Hemmati, 2002).

On the other hand, multi-stakeholder processes may lead to undue increase of some stakeholders' influence, (especially when there is a lack of transparency throughout the process), require specific financial and skilled human resources, as well time to allow for changes in cultures towards public participation in decision-making.

Few city authorities and other local stakeholders have experience with these so-called participatory and multi-stakeholder processes, and therefore require well-designed methods and tools, technical assistance and staff training. Spaces for participation should be created and formalised. Special consideration needs to be given to the non-organised and often excluded segments of the population (women, immigrants and youth, for example). Stakeholders involved need training in how to work together with people they have never worked with before. Innovative means to involve urban producers in identifying, developing and monitoring urban agriculture projects and policies is needed. This also means that urban producers should learn to negotiate with different levels of government and other external agencies to achieve their

Petra Jacobi UVPP

Group meting in Dar Es Salaam

goals. Funds would be needed to jointly implement defined action and policies. Yet, questions remain on how to effectively use multi-stakeholder processes to influence policymaking and planning.

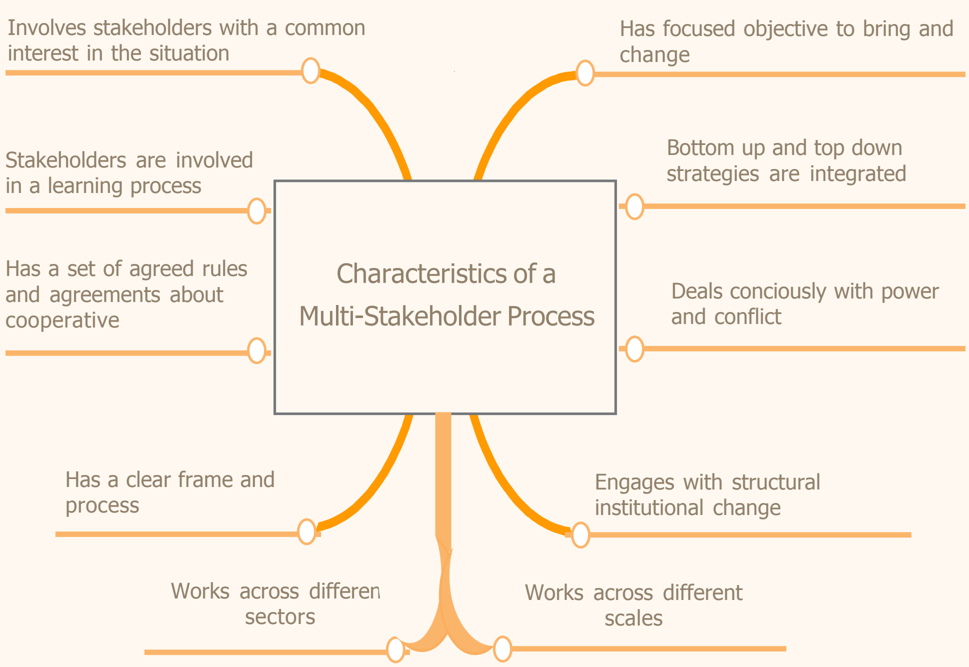
This chapter intends to respond to the issues stated above, describe and illustrate different experiences and suggest a general approach for multi-stakeholder action planning and policy design for urban agriculture. Further chapters will then illustrate specific policy fields related to UA (land use planning, financing of UA, marketing of UA, gender and UA) as well as describe in more detail different production systems such as urban horticulture, forestry, livestock and aquaculture.

Multi-stakeholder Processes on UA: What and How?

Multi-Stakeholder Processes (MSPs) are:

- processes that aim to involve stakeholders in improving situations that effect them
- forms of social interaction that enable different individuals and groups, who are effected by an issue, to enter into dialogue, negotiation, learning, decision making and collective action
- about getting government staff, policy makers, community representatives, scientists, business people and NGO representatives to think and work together (see also http://portals.wdi.wur.nl/msp/).

Figure 2.1 *Characteristics of a MSP*



At the heart of MSPs lies the capacity to design a process, in which different stakeholder groups engage in diverse forums and activities so that,

- knowledge is generated;
- ideas, values and perspectives are shared and contested;
- conflicts are negotiated;
- principles for action and policy design are defined, and
- collectively binding decisions are made.

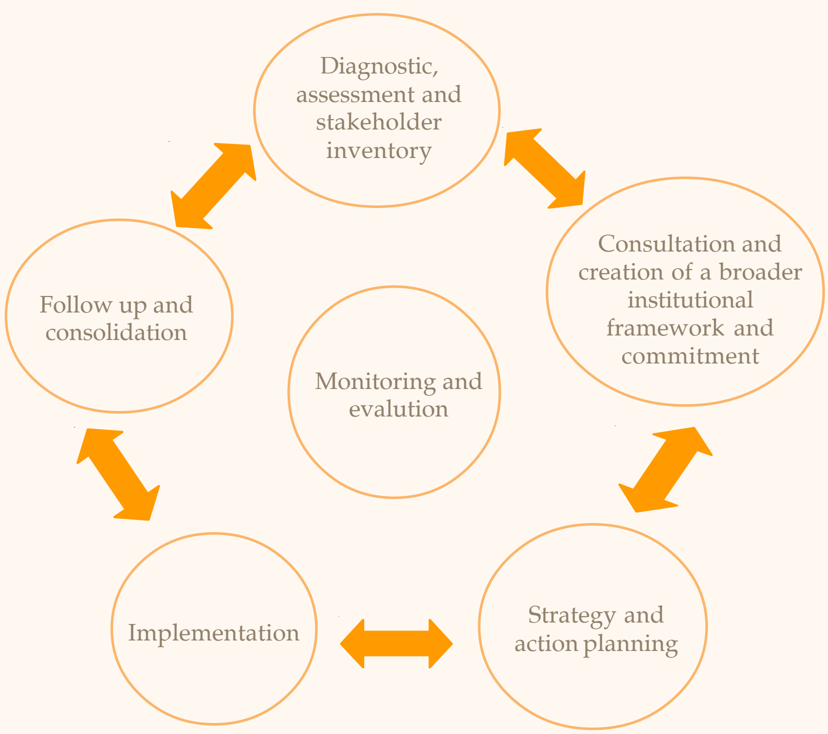
The skill and art of facilitating any MSP is to create situations where people can learn collectively on how to improve their situations. This does not necessarily mean trying to gather all interested stakeholders in one place at one time. Rather, an MSP is likely to run over months, if not years, and will involve different combinations of stakeholders working together in diverse ways. The wide use of participatory planning processes has led to the development of diverse methodologies with varying purposes (http://portals.wdi.wur.nl/msp/).

Broadly speaking, MSPs are built around the different and iterative phases of (UN-HABITAT and UNEP, 1999):

1. Diagnosis, assessment and stakeholder inventory;
2. Consultation to confirm political support and consolidate stakeholder participation;
3. Strategy and action planning;
4. Implementation,
5. Follow up and consolidation, and
6. Integrated monitoring and evaluation (see also figure 2.2).

These phases or steps are described below.

Figure 2.2 *Phases of a MSP*



Any MSP approach should accept the reality that there are many different and often conflicting interests with respect to any particular development question. Motivating the different stakeholders to participate in the process requires understanding and responding to their different needs. Bringing together different stakeholders in processes where individual or group power and interests are at stake requires skills in conflict mediation, resolution and facilitation, and transparent information sharing in order to arrive at informed decision-making.

Multi-stakeholder processes dealing with UA were amongst others developed in the context of implementation of Local Agenda 21 (as is the case of Vienna-Austria), the UN-HABITAT's city consultations or city development strategies, promoted by its Sustainable Cities and Urban Management Programmes (Quito-Ecuador, Rosario-Argentina –see attached case study- , Dar Es Salaam-Tanzania), or more recently in North American and Canadian cities promoting sustainable food systems through Food Policy Councils (i.e. Toronto and Vancouver-Canada - see also the attached case study- Arizona, Michigan and San Francisco – USA). Systematic review of these experiences (see also box 2.1) have led partners of the International Network of Resource Centres on Urban Agriculture and Food security (RUAF) to use MSPs in UA in various partner cities around the world (see further www.ruaf.org).

Box 2.1 *Analysis of experiences with MSPs on urban agriculture*

Analysis of various experiences indicates that MSPs in UA should integrate elements of:

Enhancing public awareness and motivating the different stakeholders to actively participate in action planning and **policy design**. A prerequisite for any policy related to urban agriculture is the recognition of the value, the benefits and the resulting needs of urban agriculture by political leaders and heads of administration. Therefore it is necessary to raise their awareness on the issue, and to provide them with adequate information. It is also useful to demonstrate the positive aspects of urban agriculture with some local examples. Publicising the issue through opinion-makers and leaders such as the media is another strategy. Urban producers themselves should also be mobilised to participate, to enhance political pressure and to be involved in strategy and action planning.

Capacity building among local actors for developing participatory processes of diagnosis, problem identification, implementation of solutions according to previously established priorities, conflict mediation and negotiation, policy design and joint implementation of actions, systematisation, monitoring, and control of municipal policy changes.

Building trust and cooperation among the main actors (building commitment). Permanent and transparent information flows among the different stakeholders is crucial in this respect, as is communication on agreements made, implementation of these and results. Commitments among different actors can be formalised by means of an inter-actor agreement or any other formal arrangement for promoting transparency and institutionalisation of the process. To develop the AGRUPAR Program (Agricultura Urbana Participativa) in Quito (Ecuador), the local government, several NGOs, UMP-LAC/UN-HABITAT, and community representatives signed an Inter-Actor Agreement for carrying out a participatory diagnosis and for developing an action plan on UA.

Policy making as well as joint action planning and implementation. Efforts to establish policies before initiating action planning/implementation often result in policies that do not work due to lack of political will, lack of resources or severe distortions during translation into actions later on in the process. On the other hand, actions that are not translated into adequate guiding/facilitating policies tend to stay rather localised with few or less sustained impacts on the livelihoods of larger segments of the population. Policies should relate to current UA activities and farming systems as well as new activities identified in a multi-stakeholder planning process.

Review and adaptation of existing legal frameworks (regulations on health, land use, housing). A review and analysis of the policy and legislative framework in Zimbabwe (Makonese and Mushamba, 2005) for example identified that there is no written government policy statement specifically addressing UA in Zimbabwe. A legislative framework for UA does exist but scattered in national legislation and municipal by-laws. The study thus recommends that the Government of Zimbabwe promulgates a clear statement and law on UA so that actors in the field can be guided accordingly and programmes can be implemented in the framework of the policy.

continuation **Box 2.1**

Early implementation of initial actions (such as pilot projects, new techniques) at local level and good communication of successes. Actions that produce tangible results help to reinforce the commitment and participation of those involved and inform public policymaking. It is useful to develop, from the outset of the process, pilot projects or actions that produce outputs or have an impact in the short term, which create a positive environment for more complex and long-term processes.

Resource mobilisation through incorporation of priority actions into the operational plans and budgets of the various participating organisations and institutions. For example, the inclusion of UA in the municipal budget was an essential component in the promotion of urban agricultural activities in Rosario (Argentina), where the City Council guarantees resources for promotion, training, and marketing activities (Cabannes, et al., 2003).

Creation of joint monitoring and evaluation mechanisms to provide a flow of systematic feedback to all stakeholders involved. It is important to monitor results and impacts of the MSP not only as a mechanism to evaluate the effectiveness of the strategies applied (and adapt it accordingly if needed), but also to be able to communicate successful efforts to a wider public and thereby create opportunities for further change.

Source: Dubbeling M. and H. de Zeeuw, RUAF's approach to multi-stakeholder processes for action planning and policy design (MPAP) on urban agriculture: concepts and process. Session Handout RUAF Start-up workshop April 2005. Leusden, The Netherlands.

Step-by-step

Preparatory actions

The initiative for developing an MSP will most often be by one organisation taking the lead in raising awareness and motivating other stakeholders to become involved. Often a project team or core group that will further promote and implement the MSP is formed. This MSP team will be responsible for facilitating and strengthening dialogue with the larger group of stakeholders involved in UA who will become involved in further communication, analysis, and action planning or policy design.

It is helpful if local MSP teams integrate community members/urban producers, NGO or University staff and (local) government representatives from the start. Representatives of urban producers could provide insights into their experiences, views and needs, and facilitate contact with other urban producers. NGO and University staff could support action-oriented research and facilitate the dialogue between producers and government representatives. Local government representatives can facilitate access to certain information (for example statistics on UA, land use maps, laws and regulations related to UA) and support in describing and analysing the legal and institutional context in which UA is currently taking place or will take place in the near future (depending on strategic city development plans for example).

Whenever possible, it is important in this first phase to negotiate and formalise initial agreements and commitments (see box 2.2 for a sample inter-actor agreement elaborated in Quito-Ecuador) on how the process will take place, what objectives it is aiming at and which stakeholders will participate in what role, to promote transparency, building of trust and institutionalisation of the process.

Diagnosis, assessment and stakeholder inventory

Diagnosis and assessment

Diagnosis and assessment often take the form of situational analysis, diagnosis or baseline studies and are concerned with describing, understanding and analysing

a. the local socio-economic, institutional and legal context in which UA takes place (characteristics of the city, legal and planning framework related to UA, stakeholders involved)
b. the presence and location of urban agriculture in and around the city
c. the variation in UA farming types (horticulture, forestry, livestock or mixed systems) and activities (recycling, production, processing, marketing), and their functions or impacts
d. an inventory of (probable) key issues to be addressed including the specific problems encountered, development potentials of UA in relation to poverty alleviation, environmental management or social integration, and changes that might affect urban agriculture in the future – for example in relation to land use pressure, transport network development, and guiding the formulation of potential interventions for action.

Box 2.2 *Inter-actor agreement for development of an baseline study and action plan on urban agriculture*

We (names of stakeholders ....) sign the present inter-actor agreement, containing the following clauses:

First clause - Objective
The above-mentioned stakeholders agree:

(a) To gather data on the development (key data and impacts), farming types, involved stakeholders and key issues (problems) of urban agriculture in the city (baseline study),
(b) To facilitate and strengthen dialogue with involved stakeholders to identify broad strategies to address these key issues, highlighting the consequences if key issues are not addressed,
(c) To regularly monitor project development and results, and
(d) To disseminate project results through different local forums and media.so as to encourage other organisations to join in further development of action planning and policy design on UA.

Second clause - Project Team
A Local Project Team has been formed to facilitate the process of participatory diagnosis, action planning and establishment of a multi-stakeholder platform on UA. The actors signing this present agreement will form part of this team and will be in charge of planning and implementation of the activities.

Third clause – Tasks of the Local Project Team
(a) Coordinate all the efforts needed to implement the afore-mentioned activities using a participatory and multi-stakeholder approach, and ensure the results are achieved,
(b) Assign a project coordinator who will maintain efficient communication among team members,
(c) Support project implementation with human and financial resources and existing logistical facilities:
- the local government will make available the latest land use (GIS) maps and cadastre, as well as the present city development plans and legal/normative frameworks related to UA
- the NGO will make its office and communication facilities available for regular team meetings
- the University will support participation of two students for field work and organise transport to the field

(d) Identify and mobilise new stakeholders and donor agencies that will contribute to successful project implementation and further development of an action plan,
(e) Prepare monthly reports on activities realised, results achieved and lessons learned to facilitate project monitoring and inter-regional exchange.

The agreement can be modified upon agreement of all signing parties. (signatures of all stakeholders .....)

Source: Translated from the Spanish version of the inter-actor agreement elaborated in the context of a city consultation on UA, supported by the Quito municipality, IPES/UMP-LAC and IDRC. (2000-2002).

To be able to formulate more inclusive proposals for action later on, diagnosis and assessment should explore issues of gender (See also chapter 5) and generation gaps, and should include the communities' (farmers) perceptions and values.

A combination of different tools and techniques can be applied to collect the necessary data and information:

- Analysis of existing literature and research reports; review of available statistics
- Analysis of city maps and available Geographic Information Systems (GIS) materials; visits to various parts of the city and its surroundings (field studies)
- Identification and mapping (e.g. with GIS and local observations) of agricultural activities in the city, available open spaces that could be used for UA and classification of the suitability of those areas according to various criteria (see Box 2.3 and Rosario case study attached)
- Interviews with key informants or focus group meetings with representatives of the various stakeholders and farmers
- Participatory Rapid Appraisal (PRA) exercises in selected areas.

Box 2.3 *Identification and mapping of urban agriculture and vacant land areas*

Identification, mapping and analysis of (potentially) productive land areas in the context of UA and farming systems will provide important data such as areas of land already under cultivation, the area of vacant land that potentially can be used for UA, and the importance of specific types of UA systems. It will also lay a basis for further definition of ways and means to include UA into municipal physical planning policies and practices that increase the access of the urban poor to available and suitable space for food production.

As illustrated by the Rosario case study (attached to this chapter) and in order for vacant areas to become urban productive spaces, reliable and up-to-date information is necessary on aspects such as ownership, soil quality, contamination and characteristics, accessibility and land use regulations. Such information facilitates decision-making on the type of land best suited for the purpose, and how and for how long it can be designated to urban agriculture.

Often the exploratory study will be followed by more focused in-depth studies of specific problems and potential solutions. Diagnosis and assessment thus form the basis for policy development and planning of UA projects, as illustrated in Accra-Ghana (see Box 2.4). Involving the stakeholders identified in the assessment can also help to strengthen collaboration between the actors involved in UA.

Stakeholder inventory

Stakeholder analysis can help define who to involve in designing a MSP and how, and find out whose information needs must be considered. This exercise is useful:

- to identify which stakeholders to involve in (re-) designing a project or programme, and to assess their interests and how these relate to the project/programme.
- to use during a specific phase or for a specific project component to analyse stakeholder relations, including cooperation and conflicts and considering external factors affecting stakeholders and their activities. It can assist you in making an appropriate selection of the stakeholders most central to the task/issue at hand.
- to provide a foundation and strategy for participation throughout the project/ programme, thereby making it easier for stakeholders to learn from each other (http://portals.wdi.wur.nl/msp).

Box 2.4 *Exploratory study in Accra, Ghana*

An exploratory study on urban agriculture in the Accra metropolis (June-September 2005) contained four components: (1) Inventory on urban agriculture (2) Land use mapping and GIS (3) Review and analysis of the policy and legislative framework on urban agriculture, and (4) Stakeholders' inventory and analysis. Two documents are to be produced from this study, including a policy brief prepared in consultation with policy makers, and a study report for discussion with the identified stakeholders. The exploratory study revealed the phenomenon of UA in the Accra Metropolis, and highlighted constraints for its development, especially in terms of UA in relation to urban growth and increasing land use values. It has provided a basis for planning and identifying the policy directions that need to be pursued. There are currently no specific policies for UA, however, the by- laws and regulations of the Accra Metropolitan Area put limitations to livestock production (obviously due to health and environmental concerns). Strategies for implementing an UA programme in Accra will have to be approached from a perspective of awareness creation, lobbying, negotiation and capacity building, as well as reviewing existing (livestock) policies and developing new policies and pursuing livestock integration in land use planning.

Source: Larbi, T., O. Cofie and T. Schutz, 2005. RUAF Progress Report July- September, 2005. IWMI-Ghana, Accra-Ghana.

Defining which stakeholders should be involved and when they should be involved in a MSP process is thus largely dependant on the defined purpose, but can also be influenced by the pragmatic identification and involvement of certain stakeholders to effectively reach results (Box 2.5).

Box 2.5 *Key questions to identify stakeholders*

- Who might be affected (positively or negatively) by the concern to be addressed?
- Who are the "voiceless" for whom special efforts may have to be made?
- Who represents those likely to be affected?
- Who is responsible for, can control or influence what is intended?
- Who is likely to mobilise for or against what is intended?
- Who can make what is intended more effective through their participation or less effective by their non-participation or outright opposition?
- Who can contribute relevant knowledge, expertise or financial and technical resources?
- Whose behaviour has to change for the effort to succeed?

The type of stakeholders involved in UA and their level of participation in the process will vary depending on local circumstances. It is important to identify the current mandate and roles of the different stakeholders in relation to UA development and the relevant information they have on UA and related projects and policies, and get their views on the potentials and risks of UA, and their contributions (human and/or financial) to the MSP. The inventory and analysis will enable the development of a strategy that motivates and facilitates the participation of various stakeholders and identifies their potential roles in the different phases of the process (diagnosis, planning, implementation and monitoring). Some of these roles are identified below (de Zeeuw, et al., 2001):

Local, provincial and national governments play a key role, ensuring the availability and secure tenure of land and water, access to public services, approval of regulations and standards. These different levels of government are already engaged in many areas of service provision and regulation, such as urban planning, water treatment, waste collection, management of green spaces, which have direct interactions with urban agriculture. Activities started up without the involvement of those who influence decision-making (mayor, council members, heads of departments, policy advisers) may achieve little in the long term. Therefore, it is essential to involve government representatives in the discussions throughout the planning process, in order to acknowledge their opinion and suggestions, overcome possible resistance and gain support for policy review and formulation.

Interaction between different levels of government, as well as between governments and other decision-making bodies should be specifically looked into as the Delft, Vancouver and Rosario case studies illustrate. From the outset, Vancouver's Food Action Plan for example acknowledged that some of the resources and policy tools necessary to address food system issues fell outside of the jurisdiction of Vancouver City Council. As such, the development of partnerships with other agencies has been and will continue to be instrumental to the process. Key partners include Vancouver Agreement, Vancouver School Board, Vancouver Park Board and Vancouver Coastal Health and community organisations (Mendes, 2005).

Also, UA does not always share the same boundaries as local authority areas. Therefore, it is worth considering at the very onset of the process whether cooperation with neighbouring local authorities is sensible and beneficial. Although resources can be shared and actions made more effective, varying political interests between municipalities could well complicate the process.

Commercial and subsistence farmers and gardeners and their organisations
One should bear in mind that urban producers do not form a homogeneous group. Livestock farmers have different interests from horticulture or aquaculture farmers. Commercial farmers differ in their interests to subsistence or hobby farmers. Promotion of different UA production systems therefore requires different policies and interventions (see also other Chapters in this book). Taking into account the expertise, local knowledge and views of different producers and producer groups is important in this regard. As direct stakeholders, urban farmers should also play a key role in project management and coordination, and in the evaluation and control of the activities carried out.

Micro-enterprises involved in urban agriculture
Alongside urban and peri-urban farmers and gardeners, specialised micro-enterprises are also involved in the production of agricultural inputs (eg. compost), the processing of agricultural produce (eg. Making cheese, jams and marmalades, dried fruits and flowers) and marketing (eg. street vending of fresh products or processed food, small shops and local markets, food box schemes, etc.). An important aspect in the development of UA programmes is strengthening of linkages between the different parts of the production chain (input supply, production, processing and marketing).

Residential neighbours and other interest groups
As already mentioned, urban agriculture may play an important social role in providing opportunities for education, training, recreation and leisure. Actions to promote the social aspects of urban agriculture should be discussed with the targeted groups (i.e. children and schools, urban citizens, community and health care organisations) and their associations. Among citizens, it would be important to involve individuals or groups, whose dwellings or activities are located near sites of urban agriculture, and who are or might be affected positively (improved greening and contact with nature) or negatively (pollution, noise) by current and future UA activities.

NGOs, community-based organisations and universities
Urban producers may lack expertise regarding specific aspects of urban agriculture (i.e. specific production or processing techniques). Universities, research centres or NGOs could provide support for the development of appropriate technologies for food production and processing and provide methodological support in diagnosis, monitoring, and training. NGOs or community-based organisations could also play a crucial role in linking urban producers with governmental authorities or research institutes. Finally, these organisations

could often help finance and implement projects that are defined as a result of multi-stakeholder processes.

Private sector and support organisations
The private sector and support organisations can play a role in facilitating access to inputs and services (e.g. marketing.). In El Rímac (Lima-Perú) for example, the municipality signed a cooperation agreement with a private corporation, Purina Center Rimac Corn (producer of poultry food), whereby the company took responsibility to provide training and technical assistance in poultry-raising to interested farmers free of charge (Cabannes , et al., 2003). The role of micro-finance institutions or credit-cooperatives should be considered regarding different forms of financing for UA (see also Chapter 4)

Policy narrative

Based on the diagnosis, assessment and stakeholder inventory, a study report or 'policy narrative' could be elaborated (see also Box 2.3). This document can serve as a good instrument to brief the larger group of stakeholders and to advance the planning process with them.

The policy narrative can include:

1. Presentation of the key data regarding urban agriculture in the city (presence, types and locations),
2. Important constraints encountered by urban farmers and other actors,
3. Expected potentials of urban agriculture for various policy goals,
4. The expected negative consequences of non-intervention / continuation of the present policies, and
5. Draft proposals/ outline for set up of an urban agriculture programme in the city.

Consultation and creation of a broader institutional framework and commitment

This phase aims at wider sharing of the findings of the diagnosis and assessment, strengthening and broadening involvement of the different stakeholders, formalising and approving new commitments to the process (eg. by signing a new inter-actor agreement defining more specific tasks, responsibilities of different stakeholders and funding mechanisms) and setting up a structure(s) or platform(s) that will guide and coordinate future action planning, implementation, resource mobilisation and institutionalisation.

This step could be developed through:

1) ***Meetings/workshops or focused consultations*** with the direct and indirect stakeholders to:

- a. Discuss in-depth the most important problems/issues identified and to explore alternative solutions and intervention strategies
- b. Discuss their possible roles and identify available human and financial resources to support development of an UA programme and check/strengthen their initial commitments.
- c. Discuss the organisational set up of the intended UA programme.

The workshop/meetings will eventually result in initial commitments of the institutions and organisations to cooperate in the preparation and implementation such a programme.

2) The constitution of a ***multi-stakeholder structure/platform or forum*** to give continuity to and promote the empowerment of all the stakeholders in the MSP. The objectives and tasks of such multi-stakeholder forums could include:

- Bridging the communication gap between direct stakeholders and the institutional actors in urban agriculture and functioning as a more permanent platform for information exchange and dialogue,
- Coordinating the planning, implementation and monitoring of a concerted city agenda on UA, including activities related to policy analysis, lobbying and formulation
- Stimulating the institutionalisation of such activities.

The forum should preferably operate with a formal status and institutional commitment. The importance of local ownership and member contributions to the functioning of the multi- stakeholder forum and implementation of activities should be stressed. In addition external resources may be mobilised by involving donor agencies in the forum.

One of the first activities of the forum can be to agree on a City Strategic Agenda on UA (identifying policy objectives and including agreements on the key issues in UA that the city wants to work on). The strategic agenda includes preliminary strategies and an assessment of their likely impacts on living conditions and urban development, together with an examination of institutional and managerial implications. In most cases the strategies proposed are not alternatives, but a variety of overlapping and complementary strategy components. These strategy components, with the associated implementation instruments, will form the basis for elaboration of detailed action plans at a later stage, as illustrated by the example of Governador Valadares in Brasil (see Box 2.6).

Strategy and action planning and implementation
On the basis of the diagnosis and assessment and further consultations, strategies and actions will be defined as part of ***an action plan*** that identifies and operationalises solutions (action / activities) to meet local needs and identified key issues.

Strategies and actions forming part of an action plan can include:

- pilot or **demonstration projects,**
- **capacity building** activities,
- further **research** or studies,
- **review and adaptation of municipal policies**, legal and normative tools,
- development of **new structures of financial management and allocation of resources** (setting up of rotating credit funds, channelling public subsidies), and
- setting up of new **institutional structures** that promote and guarantee community participation.

For example, action plans developed by various cities have included the following:

- Promoting safe re-use of urban organic wastes and wastewater in agriculture by establishing quality criteria for compost and wastewater used for irrigation, establishment of low cost facilities for sorting of organic wastes and production of compost, animal feed or biogas, implementation of pilot projects with decentralised collection and treatment of household wastewater for re-use in local agricultural production, farmer education regarding the health risks associated with re-use of urban wastes and ways to mitigate those risks (proper crop choice, selection of irrigation methods - Accra-Ghana, Hyderabad-India, Dakar-Senegal);
- Enhancing support to processes of technological innovation in urban agriculture by improving the coordination between research institutes, agricultural extension agencies, NGOs and groups of urban farmers, improving the access of urban farmers and micro-entrepreneurs to credit programmes, and strengthening organisations of urban producers (Rosario-Argentina; Beijing-China; Gabarone-Botswana);

Box 2.6 *Elaboration of an urban agriculture action plan in Governador Valadares, Brasil*

In Governador Valadares (GV), an exploratory study on urban agriculture was conducted in 2002. Analysis of the data showed that agricultural production is practised by around 80 percent of all households. The main crops planted include fruit trees, vegetables and medicinal plants. The areas used for UA production are basically limited to privately-owned household plots. The limited availability of land was identified as the major obstacle for further UA development, though land use maps have shown that large areas of vacant (public land) are available in GV. This indicates a problem related to individual or communal access to non-household plots (for example green spaces, river margins, and institutional land). Other problems identified relate to the lack of water for crop irrigation and lack of support for UA production and marketing.

In GV, a Municipal Forum on Urban Agriculture and Food Security was called together upon finalisation of the exploratory study. The forum counted over 100 community representatives (men and women) selected by the community. Neighbourhood associations, public schools, university and faculty members, church representatives and governmental secretariats (environment and agriculture, planning, city council representatives) were also invited. The forum's first event was used to present the results of the exploratory study (the policy narrative) and to find common agreement on the development and general objectives for a city action plan on UA.

Key issues for UA were discussed and prioritised and three objectives of an action plan on UA were defined: (a) improve access to public and private spaces for UA (2) provide funds and other incentives for UA production (3) stimulate the use of water sources other than drinking water for UA.

A working group was established to identify and elaborate possible strategies to fulfil the defined objectives. The working group then called together a meeting of community and farmer representatives. The community representatives were split up in three groups of adult men, adult women and youth (both sexes) each of which had to prioritise what they considered to be the most important strategies. In a follow-up community meeting 10 actions that were considered most important by all three groups were identified.

A task group was then formed with farmer and community (men, women and youth) representatives and representatives of the local government, NGOs and other institutions, to prepare a draft local action plan, taking into account the feasibility of implementing the 10 actions, institutional interest and commitment to support the plan and a possible time frame.

At the second forum discussion this proposed action plan was presented to the entire forum. The strategies for implementing the action plan were discussed and the roles and contributions of different stakeholders were agreed upon.

The following results were achieved after two years:

- 13 Community gardens were established,
- An Association of Community Gardeners was formed,
- The first urban farmer market was inaugurated,
- UA was incorporated into the general City Plan,
- Regulations for ceding public and private areas for UA were developed and implemented,
- Economic incentives for UA production (reduction in property tax and water tariffs) were provided.

The Municipal Forum on UA and Food Security continues to function (end of 2005).

Source: Summarised and translated by M. Dubbeling (ETC/RUAF) from Lovo, I et al., 2003. Cidade Verde: a agricultura urbana promovendo seguranca alimentar e nutricional. Governador Valadares-Brasil.

- Promoting ecological farming practices through farmer training and local experimentation with ecological farming methods, providing licences and incentives (eg. tax reduction) to micro-enterprises that produce and supply ecologically friendly inputs (compost , bio-pesticides, quality seeds - Havana-Cuba),
- Facilitating local marketing of fresh urban-produced food by authorising local farmer markets, food box schemes and other forms of direct selling of fresh agricultural produce to local consumers and creation of the minimum infrastructure required for local farmers markets, and enhancing urban producers' access to market information (Governador Valadadares-Brasil; Rosario-Argentina, Hanoi-Vietnam).

Actions can be prioritised for short-, medium- or long-term implementation, based on the expected impacts and the potential for scaling up, the problems that could arise if no action is taken, the number of expected beneficiaries, and the viability of implementation (social and political viability, availability of resources).

The implementation of the short-term actions is important to motivate and ensure continued interest of the involved stakeholders (by looking for short-term and concrete results). It also provides the space for learning by doing, and thereby provides valuable information for policy formulation and design of longer term projects. Therefore, it is useful to develop, right from the start of the process, pilot projects or actions that produce outputs or have an impact in the short term, which then create a positive environment for more complex and long-term processes.

Specific attention should be paid to formulation of "affirmative actions" related to gender equity and social inclusion of vulnerable groups (see chapters 1 and 5). It is also important that the action plan is officially be endorsed by the local government. Funding for implementing these actions can be sought through local or (inter)national resources.

Follow up and consolidation

Alongside implementation, policy analysis, lobbying and formulation should ensure the sustainability and consolidation of the UA programme beyond the period of a given political administration and facilitate a change in the programme's scale: from working with a small group of stakeholders and beneficiaries to working with larger groups; from working in one or a few neighbourhoods to working in many; from working in one city or municipality to working in several cities. As stated earlier, efforts to establish policies before initiating action planning / implementation often end up with policies that do not work due to lack of political will or lack of resources. On the other hand, actions that are not translated into adequate guiding / facilitating policies tend to stay rather localised with few or less sustained impacts on the livelihoods of larger segments of the population.

CEPAR

Participatory identification of land use in Rosario, Argentina

Review and adaptation of existing municipal by-laws, norms and regulations help to remove unnecessary restrictions on UA and to develop specific regulations and norms for legal use of various types of urban land for UA. Institutionalisation of UA into national and municipal policies and programmes is central, and can take shape through:

- Inclusion of UA in national, city or neighbourhood strategic and development plans (the normative or planning framework). The inclusion of UA into strategic development plans would give UA a much more permanent and firmer basis (see also box 2.6 on Governador Valadares). It would also create support for integration of UA into other sectoral policies on poverty alleviation and social inclusion, health and nutrition, environmental and waste management and economic development. (see case of Vancouver).
- Integrating UA in (sub) municipal land use plans. Land use plans should exist not only at the overall municipal level, but also at lower levels as in neighbourhood improvement plans, subdivision plans, district development and urban renewal plans. They should include elements of micro-planning to delineate spaces that could potentially be used for UA with clear rules concerning use, density, etc, taking into account mixed use of plots (eg., residential and agricultural). Also multi-functional land use (combinations with recreation, water management, landscape management, maintenance of buffer zones) could be promoted (see further also Chapter 3 of this book).
- Review of current municipal policies and elaboration of a facilitating (and regulating) legal framework related to UA, as done in Kampala, Uganda (box 2.7). (By-)laws, ordinances and regulations for UA could enable access to land through granting of temporary user rights, defining land taxation and tax exemptions, promoting safe use of wastewater for agricultural purposes and ecological farming and facilitating access to credit and marketing.
- Creation of an appropriate institutional framework. The roles and functions of urban agriculture within local policies are manifold. In order to develop UA's full potential to contribute to sustainable urban development, it is important that this potential is also recognised by the urban administration. This recognition should not only be reflected in the relevant political programmes and plans, but should also result in the creation of a municipal UA department or programme that incorporates institutional and municipal budgets, as has been done by Villa Maria del Triunfo-Lima, Peru (Box 2.8).

Box 2.7 *Revision of ordinances on urban agriculture in Kampala, Uganda*

In **Kampala City, Uganda,** approximately 30 percent of the households are seriously engaged in urban agricultural enterprises, of which 75 percent involve and are owned by women. Despite its positive contribution, urban agriculture has been banned for a long time, (Public Health Act, 1964 and The Country and Town Planning Act, 1964) as it is considered to be illegal, a health hazard and economically insignificant.

In 2003, the Kampala City Council (KCC) in collaboration with the Kampala Urban Food Security, Agriculture and Livestock Co-ordination Committee (KUFSALCC), spearheaded a consultative process of re-examining the Draft Bills for Ordinances related to urban agriculture in Kampala City. The KUFSALCC consists of KCC technical officials, officials from the Ministries of Agriculture, Animal Industry, Fisheries and Health, Makerere University staff, staff of the National Agricultural Research Organisation, farmers, representatives of Urban Harvest, and the Media. The review identified a number of gaps in the "Kampala City Draft Bills for Ordinances 2001" related to Urban Agriculture and Livestock. In December 2003, the Council approved the recommendations / inputs provided by the stakeholders for incorporation into the final Bills for Ordinances, with the objective of legalising UA and promoting more sustainable UA systems, while protecting public health (see for the final Ordinances: www.cipotato.org/urbanharvest/home.htm).

Source: J. Mwanga and W. Makumbi, 2003. Policy analysis and formalisation on urban and peri-urban agriculture and livestock in Uganda: A case study of Kampala City. Kampala-Uganda.

Box 2.8 *Inclusion of urban agriculture into the city's Development Plan in Villa María del Triunfo- Lima, Peru*

In Villa Maria del Triunfo–Lima (Peru), UA has been included in the city's Integral Development Plan for 2001-2010, as well as in the Concerted Economic Development Plan that is being drafted. Following the inclusion of UA in the City Integral Development Plan, the Municipality's UA Programme was created and institutionalised as a sub-department under the Local Economic Development Department, reflecting the Municipality's interest in turning UA into an economic activity. For 2004, the Municipality set aside approximately USD 50,000 from its budget for a fund to co-finance different UA activities (for input production, farming, processing, and commercialisation). This amount does not include the human resource and operational expenses of the sub-department of UA, valued at USD 20,000. The Municipality is also using and managing external resources for the development of Urban Agricultural projects.

Source: Merzthal G. and R. Barrera, 2005. Paper developed for the World Urban Forum 2006.

Participatory monitoring and evaluation

Monitoring and evaluation activities are an integral part of any MSP and should not be considered as isolated activities to be done at a certain stage or at the end of the process. Both time and funds have to be set aside for this purpose from the beginning. Monitoring and evaluation allow for the review and improvement (re-orientation) of the strategies/ methodologies used to achieve the expected outcomes of interventions by documenting and sharing lessons learned concerning both successes and failures. Monitoring and evaluation also allow for keeping track of the impacts of the MSP on policy change and on the livelihoods of different stakeholders involved, and thereby to communicate successful efforts to a wider public and to create opportunities for further change.

Monitoring and evaluation can benefit from including both internal and external viewpoints and should be developed with a gender perspective. Monitoring and evaluation can comprise both quantitative (eg. number of home-gardens established, complementary income generated from UA activities) and qualitative (e.g. improved access to and control of resources by men, women and other social groups, local institutional capacity built, uptake of projects results for specific policy or technology interventions) data.

The state government of Mato Grosso do Sul in Brazil, for instance, included changes in social and economic conditions, gender and generational gap issues, technology transfer, and environmental impacts in the evaluation of its UA programme. Surveys among urban producers and micro-enterprises were carried out for this purpose (Cabannes, et al., 2003).

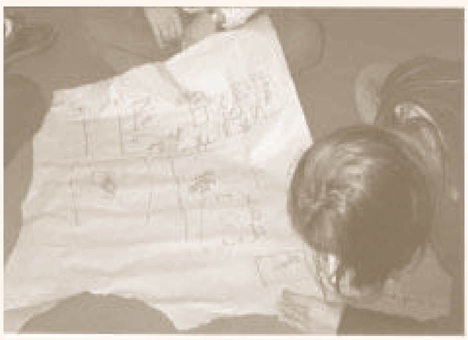
Multi-stakeholder Processes: Challenges and Future Perspectives

The hope in promoting MSPs is that these processes contribute to building participatory and democratic governance (in the cities and institutions involved) and facilitating change. MSPs are based on principles of participation, ownership and commitment, mutual trust and collaboration (in planning, decision-making and control). MSPs are in fact political processes through which power relations are redefined. One should not underestimate the challenges involved in getting around the same table partners/stakeholders who often do not trust each other (for example urban producers or community representatives and local government officials), who are afraid of being controlled or who are not at all used to these news forms of collaboration and management (political administrations in many cities have never promoted public participation). Time, perseverance, financial and human resources are needed, and feelings of ownership of the MSP should continuously be promoted among all stakeholders involved. Transparency in information sharing and decision-making, formalisation of agreements, and implementation of actions that lead to short-term results and impacts, as well as visualisation and dissemination of these results are all important strategies to sustain MSPs.

Three specific challenges related to some of the above mentioned issues in terms of (1) strengthening the organisation of urban producers to support their participation in processes of planning and decision-making (2) improving impact monitoring on UA and (3) institutionalising not only UA but also the MSPs themselves are highlighted below:

Strengthening (involvement of) urban producers' organisations

The integration of UA production systems into urban policies and planning, the allocation and combination of appropriate UA with other urban activities and technical assistance to producers to improve their practices are only possible if government and other agencies can relate to UA producers as legitimate actors or stakeholders in processes related to urban management and decision-making. In the urban arena, it is crucial for different interest groups to be organised not only to secure recognition, legitimisation, representation and direct participation, but also to get support in becoming more professional and accountable for their trade, and in increasing their contribution to the local economy through partnerships and alliances with other stakeholders. Unless urban producers form legitimate organisations, or at least find recognition and strengthening for their informal organisations, they cannot make claims on public resources nor participate in policy decisions which impact on them (Mougeot, 2005).



Alain Santandreu

A plot diagram elaborated by the community (irregular settlement El Monarca)

MSP on UA should thus be designed and implemented in such a way that they contribute to strengthening urban producers organisations (improving the functioning of existing organisations or creating new organisations), by:

- Strengthening internal management and (financial) sustainability of the organisations,
- Strengthening linkages between different farmers' organisations in the city and between producers' organisations and micro-enterprises or vendors (enhancing production chains),
- Enhancing enterprise development and marketing of produce (specifically for niche-markets),
- Supporting development and uptake of appropriate and sustainable production, processing and marketing technologies through participatory technology development, farmer-to-farmer exchange and farmer-field schools,
- Enhancing their lobbying and policy influencing capacities.

Need for impact monitoring

As illustrated in this chapter, diagnosis and assessment of UA, action plans, pilot projects, and new institutional, normative and legal frameworks on UA have been introduced in a number of cities around the world. Some cities have created municipal programmes in partnership with other local actors, including UA in municipal budgets, in development and land management plans. Other cities have issued new regulatory provisions and fiscal measures to support UA. This increased interest and commitment demonstrates the potential and calls for the need to gather more hard facts and figures on how the different forms of UA contributes to poverty alleviation, local economic development and environmental sustainability. Easy-to-measure and realistic indicators to monitor the impact of UA on urban food supply, urban employment, income and food expense savings and urban land use should be developed and more consistently applied.

Impact monitoring methods and tools widely used in rural agriculture (such as producer and market surveys, household budget and consumption registers) are sufficiently generic for application in the context of urban agriculture. However, potential limitations to the use of participatory tools have to be considered, given that in many cases, urban farming is not a legal activity per se, and farmers have felt uncomfortable mapping their fields or sharing production data. This calls for more formal / structured methods to generate quantitative, technical information that is more familiar and acceptable to urban government leaders and policymakers. GIS to map green urban spaces and large-scale surveys to determine the contribution of agriculture in the city to meet urban food demand are some examples.

Petra Jacobi UVPP

Ward Profile Map Drawing for monitoring activities related to urban agriculture

As is the case with any form of monitoring, the use of these tools and impact indicators for UA and the analysis of findings have to be judged also on their limitations. A food consumption survey for example may not reflect urban reality if it ignores food supply from street kitchens and vendors, particularly for the highly mobile working sector of the urban population who rely on street food. Furthermore, formulation of impact indicators suffers from definitional and boundary-setting problems that plague urban agriculture in general. As long as approaches are not homogenised, it becomes difficult to really compare data between different cities. There is a definite need for more case study material on measuring UA impact, on conventional and participatory approaches applied and on the specific tools used (Campilan, et al., 2003). In short, a more systematic effort is needed to improve the breadth, frequency and consistency of monitoring UA. This may be partially achieved by incorporating UA related indicators into common urban databases and monitoring programmes, such as the Global Urban Observatory, the Millennium Development Goals and the World Food Reports.

It should be made clear however that most of these indicators and programmes are related to monitoring **outcomes** of development projects and not so much to the **processes** that lead to the outcomes. Therefore, it is suggested that additional work should be done in order to clarify and demonstrate how and to what extent UA connects with and impacts upon urban governance or participatory democracy as examples of process monitoring.

Institutionalising MSPs

Traditionally, participatory approaches have focused primarily on communication and planning aspects among stakeholders and less on the institutional dimension. Here, the term 'institution' is not being used as a synonym for organisation, but in the broad sociological sense to mean any established law, custom, social practice or organisation that forms part of the social structure and influences the regular patterns of human behaviour. In other words, institutionalisation of MSPs is about making multi-stakeholder processes the "regular way of doing things". The changes needed to effect this change take time to be understood, accepted, and routinely applied. It demands steady, gradual and progressive changes in people's understanding and acceptance of the principles of participatory planning and decision-making on the one hand, and corresponding adaptations in institutional structures and cultures on the other. The purpose of institutionalisation is to build incrementally upon the impacts achieved by MSPs in UA and to turn the steps of the MSP into familiar and repeatable day-to-day practices.

What to institutionalise?

a. **Principles of participatory planning and decision-making.** These principles have to be understood, accepted and integrated into attitudes, behaviour, and routine institutional procedures. They include: stakeholder involvement as integral to decision-making; focusing on connectivity between issues, sectors and institutions; shifting from a sectoral approach to planning to a more integrated approach considering cross-cutting issues and establishing strategic planning and management founded upon co-operation and collaboration around issues.
b. **Capacities and functions.** These are the technical capacities and expertise that are built up through the participatory planning and decision-making process, and which support activities within the different phases of a MSP (for example, diagnosis and assessment, or action planning). These specialised capacities and functions allow different actors to collaborate more effectively, complementing each other's capabilities and roles, and are also the system- wide functions and general capacities that are needed by all or most of the participating stakeholders.
c. **Products of the planning and decision-making process.** These are the concrete outputs generated during the process, including specific strategies, action plans, investment project profiles and proposals, funds mobilised for implementation, demonstration projects implemented etc.

How to institutionalise?

The scope, pace and nature of institutionalisation in a given city will be shaped by local factors, but in general the following steps are likely to be useful:

- Strengthening existing institutional structures in order to improve their effectiveness in planning, management, and co-ordination between different sectors and actors; when necessary, creating new institutions to accommodate special requirements – both technical and managerial – not covered by existing institutions;
- Changing or adjusting mandates of existing institutions in order to integrate new functions and roles;
- Identifying and tasking anchor institutions to take the lead and provide a home base for particular activities or phases;
- Linking to established strategic policy instruments such as annual budgeting, human resource allocation, sectoral work programming, etc.;
- Developing skills necessary to support and routinely apply the process (for example, information collection, negotiation, facilitation, strategy formulation, action planning, project management, etc.);
- Modifying legal and administrative frameworks to enable a procedural framework for smooth and effective functioning of institutions;
- Providing funds to support expenditure and equipment for capacity building and sustaining the framework, primarily through public budgetary provisions or allocations;
- Maintaining knowledge support and a learning process (for example, by documenting and evaluating experiential lessons and building collaboration with local research or consulting establishments) (UN-HABITAT, 2001).

The development an institutionalisation of MSPs should go hand in hand with the development and institutionalisation of UA. This chapter has described the principles, phases and challenges of a Multi-Stakeholder Process developed for urban agriculture. The following chapters will describe in more detail the technical and policy aspects of urban agriculture and provide insights in how to further develop and promote it.

Note

[1] Stakeholders are all those who have an interest in a particular decision, either as individuals or representatives of a group. This includes people who influence a decision, or can influence it, as well as those affected by it (Hemmati M., 2002).

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Multifunctional Land Use, Promoting Urban Agriculture in Europe

Tjeerd Deelstra
Donald Boyd
Maaike van den Biggelaar

Politicians and planners are faced with many competing claims for the use of scarce land in and around cities in the Netherlands. Multifunctional land use – combining different functions within one area – offers them a solution. The sole function of agriculture in industrialised countries has until recently been seen as food production. This case study in the highly populated west of the Netherlands shows that urban agriculture can be promoted in industrialised countries by regarding it as one element of a land-use combination that offers other valuable functions to society.

Many possible win-win situations exist to meet urban and periurban challenges as urban planners in the Netherlands seek to create attractive land-use combinations and satisfy the many demands placed on scarce land. Many of these combinations can be based on urban agriculture, for example:

- agriculture combined with childcare and educational facilities;
- reed production combined with recreation and wastewater treatment;
- aquaculture combined with water storage and recreation;
- production of added-value agricultural products such as cheese, jams and cosmetics, combined with recreation and tourism; and
- urban forestry, which offers health and microclimate benefits, combined with energy crops [1] and recreation.

A good example of combining land-use functions in a heavily populated area is the case of the 'Bieslandse Bovenpolder' in the city of Delft, the Netherlands.

Planning in Delft

Delft is a city of around 95,000 people in the densely populated province of South Holland. The region is home to approximately 3.4 million inhabitants with a population density of 1,179 inhabitants per square kilometre (CBS). As a result, every square metre of land is designated under the country's planning system that operates at three levels: national, regional and local, all of which have roles to play in spatial planning.

Jacques Schievink

Farming in the Upper Bieslandse Polder inside Delft, the Netherlands

In theory, the government at lower levels should operate within the framework of the objectives set out by policy at the higher levels. In turn, policies made at higher levels of government should provide general guidelines within which plans proposed at lower levels can be realised. Of course it is not always possible to accommodate the wishes of all. The plan for the mixed use of the Bieslandse Bovenpolder provides an interesting example of integration of land-use functions and policy objectives.

The Bieslandse Bovenpolder

The 'Bieslandse Bovenpolder' lies on the eastern urban fringe of Delft and comprises a total of some 35 hectares. Before the realisation of the plan described here, six tenant farmers operated in the area on annual leases obtained from the municipality of Delft. Longer leases were not granted because the municipality wanted to have access to the land on short notice in case it should decide to develop the area. This gave rise to uncertainty among the farmers and, with six farmers on 35 hectares, use of the land was inefficient in agricultural terms, even though each farmer also worked land elsewhere in the area.

The Plan

In 1996, Jan Duijndam, one of the six farmers who had for some time been considering converting his business into an organic farm, decided to act. Together with a planner from the Delft Initiatives for Nature group (IND), Jacques Schievink, discussions were initiated with the other farmers in the area. Agreement on a plan was eventually reached between the six farmers, including Duijndam's take-over of their tenancy rights.

Mark Kras

Combining land-use functions gives extra income to farmers

The 'Bieslandse Bovenpolder' plan was finalised in March 1997 and, importantly, was adopted in the manifestos of a number of local political parties for the municipal elections of May 1998. Election of a new 'green' administration meant that the plan could go ahead. Work on the ground to implement the plan began in the winter of 1999-2000. The total costs of implementation, excluding maintenance, were around Euro 100,000.

Box 2.9 *Urban farmer Duijndam in the Bieslandse Boven Polder*

Duijndam now has a twelve-year lease of the land from the municipality. He added 30 of the 35 hectares of the Upper Bieslandse polder to the 50 hectares he already farmed organically in the area, to improve economic viability. As is the case for many organic products in Europe, organic milk too commands a premium price in the Netherlands.

The remaining five hectares Duijndam devoted to nature development, including traditional Dutch polder landscape features with an ecological function: a water meadow with fluctuating groundwater level, a reed bed and marshy woodland. Each gives a habitat to wildlife that is increasingly under pressure from rising urbanisation. The nature areas are laid out along the edges of the site so as to make them visible for visitors making use of the footpaths, cycling and bridle paths constructed as part of the plan. This also means that farming can be carried out more or less unrestricted in the centre of the area.

Whilst this part of the land does not bring an agricultural income, it does generate subsidies from the provincial government for land management that benefits nature development and recreation. In addition, Duijndam receives subsidies from the local water board ('waterschap') for his contribution to their integrated water management strategy. In effect, the farmer carries out the work of others and gets paid by them for that work. Such subsidies deliver approximately 10 percent of the farmer's income.

Similar initiatives exist elsewhere in the Netherlands where local authorities have an obligation to store a certain amount of water for water-management reasons. By paying farmers to devote a part of their land to water storage, the municipality 'buys off' its obligation relatively cheaply and, in effect, the farmer gets paid for cultivating water.

The case of the 'Bieslandse Bovenpolder' shows that urban agriculture can offer cities in industrialised countries more than "only" food production. Through a combination of land uses and integration of policies between different organisations at different levels, Delft has obtained a viable organic farm, an attractive recreational area and has restored the opportunities for wildlife in the urban fringe. This in turn provides a valuable resource for environmental education in a densely populated urban region. Essential benefits in terms of the environment, health, education, recreation and nature are provided to the city and its residents. Combining land-use functions has also delivered extra income to farmers from unexpected sources.

Realisation of multifunctional land use demands integration of planning between different levels of government. In the highly institutionalised planning systems common to most industrialised countries where national, regional and local plans are drawn up, such an approach should be feasible, even though it poses some difficulties. Such integration should be accompanied by innovative economic instruments, which favour multifunctional land use, such as subsidies or tax relief, where possible. Farmers should be made aware of the possibilities of such support.


Mark Kras

Urban planners seek to create attractive land-use combinations

Integration of policy *between* different types of organisations is also vital. In the Netherlands, for example, independent water boards have a key role to play in water management. Any decision to combine a productive function of urban agriculture or aquaculture with water storage, recreation or a natural park would require agreement between, amongst others, the water board, the province and the municipality.

The success of the Bieslandse Bovenpolder can be at least partly attributed to the fact that representatives of three different groups of society – a farmer, an environmentalist and a municipality – realised the benefits of combining multiple land use in the area.

Note

[1] Energy Crops are grown specifically for the purpose to produce large volumes of biomass and have high energy potential. The most common crops gown in the UK for bioenergy are willow (short rotation coppice) and miscanthus. Brazil has an extensive program for the production of bioethanol from sugar, whilst the U.S. relies heavily on corn for its ethanol production.

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Optimisation of the Use of Vacant Land in Rosario

Marielle Dubbeling[1]

The project "Optimising the use of vacant land in the Municipality of Rosario" was undertaken in the context of the Rosario Municipal Urban Agriculture Programme. The project was implemented in the period 2002 to 2003 by the Secretariat for Social Promotion of the Municipality of Rosario, the National University of Rosario[2] and community-based institutions and NGOs[3], and supported by IDRC-Canada and IPES / Urban Management Programme UMP-LAC in Ecuador. The project has led to the formulation and institutionalisation of an enabling regulatory and legal framework, facilitating poor urban households' access to land for urban agriculture.

Context

The city of Rosario has an area of 17,869 ha and a population of 1,164,800 inhabitants (National Population Census of 2001). Over time, the area around Rosario has grown to accommodate irregular settlements, mostly inhabited by groups of poor families, as a result of high unemployment in the region and a large rural and urban migration from provinces in the north of the country.

Raul Terrile

Participatory design of a public square La Lagunita

Unemployment and the lack of social welfare coverage for growing groups of the population have driven NGOs to progressively assume a greater role in social development programmes, with urban agriculture as a significant part of their work. Meanwhile, the government administration has gradually transformed its development activities into social programmes and policies aimed at supporting the situation of those groups excluded from the formal labour market.

A major strength the city has in terms of developing urban productive activities is the availability of numerous public and private vacant lots that can be converted into cultivable areas for groups of poor families. Therefore, facilitating access to and tenure of these productive land spaces to low-income groups is a key to achieving their inclusion in society.

The city has a large amount of vacant or partially vacant land (in total 35 percent of the municipal area), much of which could be converted to urban agriculture given its proximity to marginal settlements and existing housing projects. In fact, a high percentage of urban gardens –voluntary initiatives or fostered by the municipal Urban Agriculture Programme – are already located in these areas.

Many of these vacant lots may however not directly be suitable for agricultural production. It is therefore important to determine the potential of these lots for agricultural use. Reliable and up-to-date information is necessary to facilitate decision-making on the type of land to be used, and how and for how long it can be designated to urban agriculture. Participatory diagnosis and assessment makes it possible to determine the current situation of urban agriculture in the city, and to study the potential of using vacant land to sustain agricultural activities.

Diagnosis and Planning of Land Use

During the first phase of the project, information was gathered through participatory baseline studies, based on which an action plan was developed, outlining strategies for the optimisation of agricultural land use. During this process, the theoretical and methodological concepts "suitability" and "accessibility" were discussed and agreed upon in workshops with urban gardeners and municipal officials. The following variables were selected to define "suitability" of the land: environmental quality; potential agronomic use; actual use (and previous use, if the area has been used for example as a dump or for other hazardous activities); current regulations for land use; urban and city projects planned; water supply; and ownership. The variables considered for defining "accessibility" of the land for urban agriculture were: legal status; current regulations of access and tenure; fiscal debt; public policies; and the value of the land.

Raul Terrile

Participatory design workshop La Lagunita

On this basis, a typology of vacant spaces was developed (for example private vacant spaces, green areas, roadside or railway reserves a.o.), each type requiring different policies and interventions in order to be put to use. All vacant lots were identified on a geo-referenced base map (using Geographic Information Systems), which is now used as input for planning and monitoring of urban agriculture in the Municipality of Rosario.

Participatory Consultations

The diagnostic process combined different participatory approaches related to the collection and organisation of baseline information. Maps identifying the location and size of vacant lots were prepared and the most suitable and accessible land areas were identified. The main sources of information used included:

- Basic information on urban and city planning;
- Urban Agriculture Programme of Rosario;
- Participatory workshops held with representatives of 70 community gardens;
- Interviews with technicians, municipal officials and urban producers;
- Meetings with other municipal, institutional and community agencies;
- Consultations with programmes involved in activities related to UA, such as Prohuerta (providing seeds and technical support to home-gardeners) and Crecer (promoting food production for schools).

As mentioned, several workshops were held with representatives from producer groups. In a first workshop, the project was presented, its objectives and expected results discussed and issues for further study identified. The land use maps were used to share and visualise information on land use regulations, ownership and use of the identified vacant land areas. The maps were also used by the participants to locate their urban gardens and additional potential vacant land areas for agriculture. The second workshop, aimed at making an in-depth characterisation of UA gardens already in operation, characterising the social groups that work in the gardens, and collecting supplementary information to determine the suitability and level of accessibility of existing gardens and identified empty lots. The third workshop focussed on deepening understanding of the problems experienced in gaining secure access to land; defining related conditions and requirements for farmers, and identifying policy support needed from the municipality. The community workshops also identified the need to improve the suitability of the land for agriculture. Therefore a specific study was undertaken to identify low-cost techniques for soil improvement, resulting in a training manual for urban farmers.

The proposals made by the community were shared with several municipal departments involved in land use planning and management (City Strategic Planning office, Secretariat for Housing, Land registry, Parks and Gardens Department) and were analysed by their staff at two workshops. The conclusions and recommendations of these workshops were incorporated into an action plan for optimising the use of vacant land for UA in Rosario.

Action Plan

The action plan incorporates activities aimed at converting the vacant spaces for productive use, improving the quality of soils to facilitate agricultural use, and the formulation and institutionalisation of public policies facilitating access to land.

In June 2003, *"Comprehensive Design Workshops"* were organised to involve the community and landscape architects in the design of productive uses of *garden parks in public spaces or along banks of urban streams* (see illustration).

At the same time, proposals were developed for the gradual inclusion of urban agriculture into municipal policies and plans, resulting in the *inclusion of urban agriculture into the City Master Plan*, facilitating the inclusion of UA into land use strategies, spatial and functional policies and programmes, and a variety of urban development projects.

Furthermore, *regulations on ceding of land and granting temporary user rights* to producers were formalised and a *Municipal Land Bank* was set up to permanently map and monitor the use of vacant and UA land areas.

Lastly, *procedures for the management and administration of vacant lots for UA* have been simplified by centralising them at the Secretariat for Social Promotion (which hosts the Municipal Urban Agriculture Programme), which in turn co-ordinates its activities with the Land Registry, the Planning Office and the Parks and Gardens Department. Community and individual requests for the (temporary) use of vacant lots are granted on the basis of criteria defined by the producers themselves in the community workshops, such as commitment to longer periods of farming, and the groups' management capacities.

Presently, more than 10,000 families have secured access to more than 60 ha of private, institutional and municipal land through this project for UA and benefit from improved food security, social recognition and income generation.

Notes

[1] Summary prepared by Marielle Dubbeling (IPES/UMP-LAC) based on project documents elaborated by Elio Di ernardo, Laura Bracalenti, Laura Lagorio, Virginia Lamas and Marina Rodriguez (CEAH, Universidad Nacional de Rosario- Argentina) and Raul Terrile and Antonio Lattura (CEPAR)

[2] Notably the the Centre for Human Environment Studies (CEAH) of the School of Architecture, Planning and Design.

[3] The Centre for Agro-ecological Production Studies (CEPAR) and NGO Nacimiento have actively participated in the development of project, specifically the participatory baseline study , community consultations, and development of the action plan.

Urban Agriculture and Sustainability in Vancouver, Canada

Wendy Mendes

On July 8, 2003, the Vancouver City Council approved a motion supporting the development of a "just and sustainable food system" for the City of Vancouver. A just and sustainable food system is defined as one in which food production, processing, distribution, consumption and recycling are integrated to enhance the environmental, economic, social and nutritional health of a particular place. This commitment to food policy was made in response to more than a decade of community organising efforts. Community groups sought local government response to pressing issues including urban sprawl, threats to agricultural land, health and nutrition problems, and food access issues, particularly for marginalised populations. The Council motion also reflects a growing trend in Canadian and US cities in which food system issues are being recognised as an area in which local governments have an important role to play.

Since the July 2003 Council motion, the City's commitment to food policy has included an eight month public consultation process; approval of a Food Action Plan (see http://www.city.vancouver.bc.ca/ctyclerk/cclerk/20031209/rr1.htm); hiring two food policy staff; facilitation of a number of food-related initiatives including community gardens, urban beekeeping, fruit trees, and edible landscaping; project collaborations with a range of partners; and the election of a 20-member multi-sectoral Vancouver Food Policy Council.


Wendy Mendes

Meeting of the Vancouver Food Policy Council

Urban agriculture is one component of Vancouver's broader food-related policies. These policies are being designed and implemented by the City of Vancouver in partnership with community organisations and a citizen advisory group. As one way to achieve a 'green and productive city,' Vancouver's food policy initiatives constitute an innovative municipal governance strategy that can contribute towards achieving the Millennium Development Goals (MDGs).

Box 2.10 *Community Gardens in Vancouver*

Twenty five percent of British Columbia's food is produced in areas reached within an hour of downtown Vancouver and another 25 percent within 2 hours of downtown. However, the region is also contending with urban sprawl, population pressures, farm consolidation and threats to agricultural land. At the same time, Vancouver has a thriving community of urban agriculture enthusiasts. For example, a recent Ipsos-Reid poll (2002) showed that 42 percent of people in Vancouver grow food that is vegetables, fruit, berries, nuts or herbs in their yard, balcony or community garden. Vancouver has approximately 900 community garden plots in 17 operating community gardens on Park property (11 gardens),. Engineering property (5 gardens) and City Real Estate property (1 garden), with one additional new garden under development. Furthermore, the goal of creating more community gardens was identified as a priority in the City of Vancouver's Food Action Plan (2003), as well as investigating the possibility of providing spaces to grow food in private developments.

Urban Agriculture in Vancouver

Although Vancouver is a city of soaring glass towers and modern urban amenities, it is also located within one of the most productive agricultural regions in Canada. Urban agriculture in Vancouver is used in strategies to address a range of urban challenges involving various stakeholders.

Vancouver's Food Action Plan follows a 2-tiered strategy: (1) integration into a broader sustainable urban development agenda, and (2) promoting multi-actor involvement and collaboration.

Integration of Urban Agriculture into existing sustainability policies

A sustainable food systems approach to food policy supports the social, environmental and economic goals embodied in the City's existing commitment to sustainability. Goals include the promotion of health, nutrition, ecological responsibility, social inclusion and community capacity building. In this way, one of the key policy objectives for urban agriculture and other food policy initiatives in Vancouver is integration into broader sustainable development agendas. Theses agendas include child and youth programmes, environmental programmes, social sustainability programmes and urban development programmes.

A specific illustration of the goal of integrating urban agriculture into existing sustainability policies can be found in Southeast False Creek (SEFC), a major City development. In 1991, the City Council directed that Southeast False Creek be developed as a residential community that incorporates principles of energy efficient design in its area plan and explores the possibility of using SEFC as a model "sustainable community." As a sustainable neighbourhood, SEFC provided an opportunity to integrate urban agriculture into the Official Development Plan (ODP) as it evolved.

As part of the planning and consultation process in Southeast False Creek, a citizen advisory group was set up to provide input on the Official Development Plan as it evolved. This group, known as the Southeast False Creek Stewardship Group, took a keen interest in promoting urban agriculture on the site. In at least two reports to the City Council, the Stewardship Group identified urban agriculture as a key development priority. The rationale was that urban agriculture would provide multiple benefits to future residents including environmental sustainability by reducing the distance food travels, providing ecological benefits of reducing the heat island effect, reducing cooling and heating needs, reducing storm water management costs, and possible reductions in emissions and transportation costs. Urban agriculture was also argued to enhance social sustainability by providing less expensive and more nutritious food for the residents of Southeast False Creek, as well as providing social spaces for people to meet and interact with their neighbours. Together these benefits can increase social cohesiveness and networks, which are essential for a community that relies on the participation of its members in planning and ongoing governance.

Wendy Mendes

Farmer Market in Vancouver

A second mechanism that enabled the integration of urban agriculture into SEFC was the participation of the food policy staff team in the finalisation of the Official Development Plan. By spring 2004, the SEFC Official Development Plan was being made ready for presentation to the City Council for approval. Because of pre-existing commitments to urban agriculture already embedded in the SEFC policy statement and the active lobbying by the SEFC Stewardship Group, the food policy staff team was able to work with the SEFC Planners and other City staff to more clearly articulate opportunities for urban agriculture, and express them more comprehensively and explicitly in the ODP itself.

Facilitation of collaboration and multi-actor partnerships
A second key policy objective for urban agriculture and food policy in Vancouver is the promotion of partnerships and collaboration. There are two inter-connected dimensions of the City of Vancouver's recognition of the importance of partnerships and collaboration where urban agriculture is concerned. The first focuses on 'internal' partnerships, while the second emphasises partnerships and collaboration between local government and community agencies and organisations.

From the outset, the Food Action Plan acknowledged that some of the resources and policy tools necessary to address food system issues fall outside of the jurisdiction of Vancouver. As such, the development of partnerships with other agencies has been, and will continue to be instrumental to the process. Key partners include Vancouver Agreement, Vancouver School Board, Vancouver Park Board, Vancouver Coastal Health and community organisations among others. Also key to the success of urban agriculture and food policy are partnerships and collaborations among municipal departments within local government itself.

Box 2.11 *Vancouver Food Policy Council*

Vancouver's Food Policy Council (VFPC) is considered a new model of integrated local governance involving City staff and a citizen group. The VFPC was conceived as a multi-actor body whose mandate would be "to act as an advocacy, advisory and policy development body on food system issues within the City's jurisdiction" (Vancouver Food Policy Council Terms of Reference, 2004). From May to July 2004, the Vancouver Food Policy Task Force produced and ratified a set of recommendations for the creation of the VFPC. Recommendations included VFPC member roles and responsibilities, principles and protocols: vision and mandate; structure and election process. The result was the election of a twenty-member multi-sectoral food policy council on July 14, 2004 as the last act of the Food Policy Task Force before it dissolved.

Vancouver's Food Action Plan was argued to reinforce the City's commitment to sustainability. This had the benefit of associating food policy with a set of already familiar policies and mandates. Urban agriculture and food policy benefited from internal education campaigns on sustainability that had already taken place in the organisation. Like sustainability more broadly, urban agriculture is a cross-cutting issue often involving a wide range of departments for effective implementation and monitoring.

The second dimension of the City of Vancouver's recognition of the importance of partnerships and collaboration has more far-reaching implications. This dimension involves the mechanisms designed to facilitate governmental / non-governmental partnership approaches to food policy design and implementation. This objective is best embodied in the Vancouver Food Policy Council, seen as a new model for collaborative municipal governance.

The Vancouver Food Policy Council is comprised of individuals from all aspects of the local food system. Membership includes people with a variety of different backgrounds such as, nutritionists, food wholesalers and distributors, food retailers and grocers, managers of non-profit organisations and academics engaged in the food system. This multi-disciplinary group creates an innovative forum for discussion and action towards building a food system that is ecologically sustainable, economically viable and socially just. It is also builds upon collaboration between citizens and government officials to work together on initiatives. The primary goal of a Food Policy Council is to examine the operation of a local food system and provide ideas and policy recommendations for how it can be improved.

Vancouver's Food Policy Council has been meeting since September 2004. In addition to education and awareness-raising strategies, the Vancouver Food Policy Council works on specific projects and goals in support of issues and action items identified in the Food Action Plan. Currently, the VPFC has identified four priority work areas including: (a) Increasing access to groceries for residents of Vancouver; (b) Institutional food purchasing policy for public facilities; (c) Recovery, reuse, and recycling of Food; and (d) Food Charter for the City of Vancouver.

Wendy Mendes

Showing the power of worms

Results and Way Forward

The two policy strategies have resulted in a number of behaviour changes of and benefits to Vancouver citizens. Benefits derived from these changes address Millennium Development Goals #1 (eradicate extreme poverty and hunger) and #7 (ensure environmental sustainability). At the same time, benefits also encompass a number of important dimensions of social sustainability including community development, social inclusion and civic engagement. Three changes in particular are:

- Education and awareness
- Enhanced collaboration between city departments and other agencies
- **Food systems approach to food issues**

A number of key lessons from the project experience should be taken into account by other local governments. These include:

- Build on community knowledge and expertise
- Build and enhance partnerships
- Adopt a systems approach to food issues
- Food policy staff is critical

A key next step in Vancouver's case is to determine the role that urban agriculture may play in existing strategies leading to pilot programmes to address hunger, health, addiction and homelessness. At the same time, it should be recognised that hunger exists to varying degrees in all Vancouver neighbourhoods. Accordingly, research should be based on a sustainable food system approach to alleviating hunger.

Resources

Multi-Stakeholder Processes for Governance and Sustainability - Beyond Deadlock and Conflict
M. Hemmati (with contributions from F. Dodds, J. Enayati and J. McHarry). 2002. Earthscan. London. UK.
This practical guide explains how MSPs can be organised and implemented in order to resolve the complex issues in and around sustainable forms of development, whilst recognising the rights of, and risks faced by, all parties. It includes detailed examples of MSPs in practice and provides functional checklists, explaining how to bypass adversarial politics and achieve positive results. This important contribution to the understanding of participatory approaches to decision-making will be invaluable to policy makers, NGOs, business unions, local authorities and activists.

Tools to Support Participatory Urban Decision Making. Urban Governance Toolkit Series.
United Nations Centre for Human Settlements (UN-HABITAT). Nairobi-Kenya.
This toolkit aims at supporting participatory urban decision-making. It has been prepared as one of the products of the “Global Campaign on Urban Governance”, led by UN-HABITAT in collaboration with a whole range of partners. It provides tools and short case studies on aspects such as mobilising stakeholders, building collaboration and forging consensus, identifying key issues and formulating priority strategies, negotiating and implementing action plans, monitoring and evaluation and institutionalisation.

The Sustainable Cities Programme Source Book Series, UN-HABITAT/UNEP, 1999
The Sustainable Cities Programme (SCP) is a joint UN-HABITAT/UNEP facility established in the early 1990s to build capacities in urban environmental planning and management. The programme targets urban local authorities and their partners. It is founded on broad-based stakeholder participatory approaches. The environmental planning and management (EPM) approach of the Sustainable Cities Programme (SCP) addresses the urban challenge by promoting the sustainability of cities. Experiences with EPM have been captured and translated into effective tools - in the form of manuals - that can be used to inform, support and guide the environmental planning process in cities. Five volumes of the SCP Source Book Series provide guidance on the step-by-step SCP process following similar steps as described in Chapter 2. They can all be downloaded from the following website: **http://www.unchs.org/programmes/sustainablecities/SCPProcess.asp**

- Preparing the SCP Environmental Profile, The SCP Source Book Series (Vol.1)
- Measuring Progress in Environmental Planning and Management, The SCP Source Book Series (Vol. 9)
- Urban Air Quality Management, Handbook (Parts A and B) and Toolkit (Part C), The SCP Source Book Series (Vol. 6)
- Organising, Conducting and Reporting an SCP City Consultation, The SCP Source Book Series (Vol. 2)
- Building an Environmental Management Information System (EMIS), The SCP Source Book Series (Vol. 7)
- Establishing and Supporting a Working Group Process, The SCP Source Book Series (Vol. 3)
- Integrating Gender Responsiveness in Environmental Planning and Management, EPM Series (Vol. 4)
- Formulating Issue Specific Strategies and Action Plans, The SCP Source Book Series (Vol. 4)
- Institutionalising the Environmental Planning and Management Process, The SCP Source Book Series (Vol. 5)

www. portals.wdi.wur.nl/msp/
This website gives you practical information on how to facilitate participatory learning processes with various stakeholders. It provides theoretical foundations, concrete case studies, methods and tools to create learning processes, facilitation tips, examples, literature and links. The aim of providing this information is to build capacity for multi-stakeholder processes and social learning. Tools include those that can be applied for collecting information, stakeholder analysis, planning and decision-making.

www.iclei.org
The Local Agenda 21 (LA21) Campaign promotes a participatory, long-term, strategic planning process that helps municipalities identify local sustainability priorities and implement long-term action plans. It supports good local governance and mobilises local governments and their citizens to undertake such multi-stakeholder process. The ICLEI website offers a variety of resources on Local Agenda 21 and urban governance, which include case studies, publications and toolkits.

http://www.unchs.org/programmes/sustainablecities/SCPProcess.asp

Chapter 3

Integration of Agriculture in Urban Land Use Planning

Urban agriculture is a relatively new urban issue, in which different sectors and institutions are involved. It requires the development of new planning practices, or the adaptation of existing ones,and supportive policies. The preceding chapter argues that participatory and multi-stakeholder processes and tools are required in this process. This chapter elaborates on this argument by focusing on urban land use planning. It takes a South East African perspective and analyses the different paradigms, approaches and tools towards urban policy making and planning related to urban agriculture. Major issues and challenges include the distribution, control of and access to the use of land and other resources, conflicts between uses and users and the regulatory framework for urban agriculture. The chapter ends with a discussion on planning tools and techniques which can be used to integrate urban agriculture into urban planning and development.

Integration of Agriculture in Urban Land Use Planning

Takawira Mubvami
Shingirayi Mushamba

Introduction

Urban agriculture is increasingly becoming an important activity in urban economies, both in the South and the North. It can contribute significantly to the well being of farmers and other citizens, if properly managed. The growth of human settlements creates a competition between the traditional urban land uses and urban agriculture. Whilst regional and urban planners have generally accepted the peri-urban zone as a mixed zone in terms of land use categories (including urban agriculture), the intra-urban zone in most cases remains a preserve for “traditional” urban uses.

As is argued in this book, urban agriculture, however, has the potential to prosper in modern cities because of its multiple functions and relations with city issues. Cities provide easy access to markets and a prevailing high demand for food. Other reasons for agriculture in the city are reduced transport costs for produce and an abundance of resources and opportunities (such as recycled waste, under-employment and the availability of urban labour). In fact urban agricultural practices have always been part of the city, but the integration into the urban economy is what is lacking in today’s urban planning and policies.


Henk de Zeeuw

Cultivation on the fringes of Beirut, Lebanon

Urban planning in most developing countries has tended to be characterised by long-range comprehensive planning, which adopt a blue-print approach. This type of planning is associated with rigidity and a lack of responsiveness to social issues, and has negatively affected the integration of urban agriculture. Planning departments are often ill-equipped, understaffed and the position of planners is not often at the level of real decision making. This means that their decisions are not always recognised and their plans are often shelved for lack of resources to implement them.

Box 3.1 *Land use planning in Zambia*

Land use planning in Zambia provides for exclusive land uses and does not provide for mixed land use. This implies that designated land can only be for residential use. Under the Town and Country Planning Act Cap 283 of the Laws of Zambia, the use of residential land, road reserve or recreational land for urban agriculture (as the practice is in most Zambian towns and cities) therefore contradicts the provisions of the legislation that guides physical development in Zambia. The Public Health Act Cap 295 of the Laws of Zambia also excludes the use of residential areas for urban agricultural purposes for its perceived nature as a source of disease transmission to humans. To this effect the public Health Act has prescribed measures such as destruction of crops and livestock including prosecution of such “urban farmers”. In this regard, urban areas in general have adopted prohibitive by-laws, which bar cultivation within urban confines with, at times, the exception of vegetable gardens and growing flowers.

Source: Mposha, 2005

Most planners in developing countries have a view of the city which is based on old- fashioned European or American models and pertaining to countries in which most of them have been trained. In addition, land laws in their own countries are archaic, while laws on health and environment which are promulgated at the national level leave little room for urban councils to manoeuvre at the local level (Foeken, 2006).

The scenario described in Box 3.2 is not yet a reality, although promising examples are given in this book. Urban planners and other professionals often lack information and technical know-how to cope with urban agriculture and facilitate its integration into urban development. Despite the growing recognition of urban agriculture, there are still many city planners, local authorities, sectoral organisations and NGOs who associate agriculture with rural areas only and are unaware of its presence in the urban areas.

Box 3.2 *Urban agriculture in the future*

Beyond promotional programmes and projects of the 1970s and 1980s, more national and local governments and specific public sectors will support UA in the South for food security, jobs and environmental benefits.... UA will be accepted and implemented more systematically as a major intervention in food security and social security programmes, and environmental agencies and programmes will also include more UA. Community and civic organisations will increasingly support UA and women will continue to dominate the industry. Public private partnerships are accelerating and national and local UA organisations appear destined to come together into regional networks. Food markets in many of the world's countries will carry an increasing share of products grown in the cities. Urban planning will more widely incorporate UA as another form of land use in urban space economies. In the South, and at least for some decades to come, the low-income type of UA will continue to expand, diversify supply and make fresh perishable food more affordable to larger sectors of city populations.

Source: Mposha, 1999

However, this situation is slowly changing with increasing recognition of the importance of urban agriculture in the overall functioning of the wider urban economy. Most governments and local authorities have now begun to support (peri-)urban agriculture and are seeking ways in which to facilitate sustainable, safe and profitable production. Latin American cities such as Rosario (see the case in chapter 2) have adopted a facilitating environment for urban agriculture. New capital cities such as Dodoma in Tanzania have been designed to accommodate (peri-)urban agriculture, while agriculture has been incorporated into urban expansion plans for Dar-es-Salaam and Maputo (Mougeot, 2000).

Debates surrounding urban planning standards and the feasibility of implementing these in cities of the developing world have resulted in a change in approach by planners who have realised that long-range planning is often unable to respond to the fast-changing circumstances of rapidly urbanising areas. New planning tools and approaches that are more flexible, seek greater community participation, more responsive and move away from the blue-print approach are being experimented with. The role of an urban planner has changed from that of an expert, technical designer of the future urban form to a facilitator of community needs and aspirations, often pushed or pulled by policy makers through various declarations, for example the Quito Declaration, chapter 1 and the Harare Declaration (see box 3.8).

Planners are often accused of posing the greatest challenge to urban agriculture as they have not integrated it into urban areas as a land use nor designed residential estates to allow the activity to be carried out on-plot. The central question here is how planners, urban managers and policy makers can facilitate or support urban agriculture. There is a need to understand what planning is all about and the constraints that planners face in trying to integrate urban agriculture into development plans.

Urban Land Use Planning

Urban, city or town planning is the discipline of land use planning which deals with the physical, social, and economic development of metropolitan regions, municipalities and neighbourhoods. Land use planning is the term used for a branch of public policy which encompasses various disciplines which seek to order and regulate the use of land in an efficient way (Chapin and Kaiser, 1979). Urban planners shape patterns of land use and the built environment in and around cities to solve and prevent challenges of urbanisation, including providing shelter, food and other basic needs of life, protecting and conserving the natural environment and assuring equitable and efficient distribution of community resources, including land. (Quon, 1999)

As a profession, urban planning lays claim to being comprehensive in scope, future oriented, public interest driven, and of wanting to enhance the liveability of human settlements. It is also distinguished by its focus on numerous functional systems that make up the community, including the study of their characteristics and interconnectedness (Faludi, 1973).

Land use planning

An urban area is made up of complementing and conflicting uses and demands that have to be properly managed. This scenario is made worse by the fact that land is a finite resource and the demands on a particular piece of land are many and varied.


Beacon Mbiba

Maize cultivated at open spaces in Harare, Zimbabwe

Land use planning is viewed as the process of organising the use of land and its resources to best meet the people's needs over time according to the land's capabilities. (Chapin and Kaiser, 1997) According to this definition every piece of land within an urban environment should have an appropriate use. The definition further relates to the concepts of sustainable development and use of resources.

Land use planning can also be viewed as the development of a plan for the *future* use of land, for instance, through zoning. Land use planning is not a haphazard event but should be a well thought out process. Thus, if a certain use of land, for instance urban agriculture, is not considered during the planning process, it would then be very difficult to properly include it in the implementation of the plan, and to achieve the maximum benefit.

Urban planning and the urban food system

Land use, housing, transportation, the environment, the urban economy and recreation, amongst others, are issues that planners are heavily involved in. The food system, however, is notable by its absence from the writing of planning scholars, from the plans prepared by planners and from the lecture rooms in which planning students are taught. As opposed to other commercial or private activities in cities, urban food production has never been addressed properly by legal regulation and planning (Dresher, 2000, Roberts, 2004).

The food system is defined as the chain of activities connecting food production, processing, distribution, consumption and waste management, as well as the associated regulatory institutions and activities. There are conceptual and practical reasons why planners should devote more attention to the food system, since it is paramount in the improvement of human settlements to better serve the needs of the people, and in incorporating linkages between various aspects such as physical, natural, housing, transportation, land use, and economic empowerment.

Approaches to urban planning

As mentioned, urban planning is continuing to develop and in many cities planners are experimenting with new approaches and tools, based on different views or paradigms. There is little information available on what these different visions imply for urban agriculture, although issues of importance are mentioned in various texts (Kaufmann, 2000, Quon, 1999, van den Berg, 2000). Participatory approaches are becoming more popular. Other approaches brought in by the donor community are also taking root. It is against this background that urban agriculture can be made much more visible than it currently is.

Urban agriculture could play an important role in urban planning by linking to environmental, social and economic issues (see chapter 1). All of the different approaches to urban planning provide specific opportunities and linkages to facilitate and catalyse the integration of urban agriculture into urban planning. The five models discussed below are based on descriptions from Chapin and Kaiser (1979), but are still valid.

The **Ecological Model** is most current among environmental health and transport planners. It applies a systems view, in which the city is seen as a system of inter-related parts akin to a biological system. Planning is used as an approach to make cities healthy and disease free. Open and green spaces are seen as lungs to purify pollutants from the environment. It is dominant in environmental planning and management approaches, as promoted by Local Agenda 21 (as developed after the Earth Summit in Rio de Janeiro,1992). Dar es Salaam-Tanzania and Lusaka-Zambia are cities where this approach has been applied.

The implications of the Ecological Model for urban agriculture are that:

- urban agriculture is considered as a tool for environmental management through nutrient and waste recycling;
- nutritional and health conditions of residents can be improved through urban agriculture;
- urban agriculture may constitute a good use of derelict and open spaces;
- city gardens help to beautify the city;
- potential health risks for consumers – use of waste water, soil erosion – need to be considered.

New Urbanism (design, engineering, architecture) propagates the idea of a compact city. The key feature of this model of city development is to reverse the trend of the urban sprawl by learning from traditional urban development patterns. It promotes small plot sizes and building up open spaces within the city, but also uses of recreation. The model is applied in many new cities like Lilongwe, Dodoma, and Abuja.

The implications of the New Urbanism approach for urban agriculture are that:

- economic imperatives in the new urbanism militate against urban agriculture;
- it has been criticised by those that see home space as multi-functional production areas, and not just as a place to sleep;
- the model follows the recommendations of some aid agencies like the World Bank that have been advocating for the reduction of urban residential plots, leaving very little space for urban agriculture (see box 3.3);

Box 3.3 *The case for larger residential plots – Maseru*

In Maseru, Swaziland, there has been economic pressure in support of urban agriculture. Up to the mid-1980's, it was doubtful that the planners could do much to stop urban agriculture even if they had wanted to. The main opponent to the growth of intensive horticulture in Maseru has in fact been the World Bank, whose emissaries have pressed for smaller plots for low-income households on the grounds of cost efficiency. This in turn is based on a zoning concept that treats land in residential areas as strictly non-productive sleeping quarters, rather than potentially productive land units.

Source: Greenhow, 2002

The **Collaborative or Communicative Model** is a procedural theory of how planning should be done. It acknowledges the divergent social-political and at times ethnic groups in the city, and encourages a process of consensus building in addressing problems and developing a vision for the city. The assumption is that with negotiation, problems in the city can be resolved. The model emphasises the role of the planner and the leadership s / he provides. It promotes multi-stakeholder processes (see chapter 2), in which the planner should bring consensus among stakeholders and should not impose his own blue-print as in the new urbanism model. It assumes an even distribution of power among stakeholders. The implications of the Collaborative Model for urban agriculture are that:

- the mainstreaming of multi-stakeholder processes may give a voice to urban producers and place emphasis on urban agriculture being demand driven;
- there is a need to pay attention to issues of who has power and influence among stakeholders and on how a common position on urban agriculture can be negotiated;
- urban agriculture should emerge as a community need and be expressed as such; if it is a community need, it can find its place in urban development.

The contemporary **Just City Perspective** is characterised by democratic radicalism. It calls for a radical form of participation that goes beyond stakeholder involvement. It places emphasis on governance by the civil society, and making explicit the differences in power and the need for the "excluded" to fight for power and influence change. The implications of the Just City concept for urban agriculture are that:

- urban farmers need to organise themselves so that they can effectively lobby local authorities;
- the authorities need to be engaged in debates for the rights of urban farmers to earn a living out of a legitimate and honest means;
- negotiation is necessary for the use of any open land available for urban agriculture activities; this will also involve negotiating for the legalisation of informal settlements and informal sector activities.

The **New Life Model** argues that development institutions have realised that urban agriculture can facilitate the creation of new institutions. It links urban agriculture to different aspects of urban development such as poverty alleviation, urban nutrition and environmentalism, informal sector employment and gender, and argues for further enhancement of UA in these sectors (see also chapter 1). The implications of the New Life theory for urban agriculture are that:

- urban agriculture is a new field of development or perspective in sustainable city development and needs to be taken on board in the urban development discourse;

- emphasis is on the inter-linkages between urban agriculture and other urban development issues;
- urban agriculture may attract a lot of international development assistance if properly organised and well promoted;
- in city dynamics urban agriculture will adapt and develop itself to urban needs, until another main issue (new kid on the block) emerges and becomes in vogue.

The models discussed above have shaped the way different land uses and urban forms have emerged. These models are adhered to by urban authorities and NGOs and the visions espoused in the paradigms influence the way policies are developed. By clarifying the linkages and the potential role UA can and should have in urban development, it should be possible to integrate UA and articulate it clearly in urban development policies.

Policy Formulation and Urban Agriculture

Thus it is important to clarify potential roles and positive impacts of UA in the city and link these to current planning practices and perspectives. Urban planning is undertaken under existing national and municipal policies. Therefore analysing and influencing this process of policy formulation is paramount in seeking the integration of urban agriculture into sustainable urban development. The next sections highlight the status quo with regard to the integration of urban agriculture into urban development.

Ivana Cristina Lovo

Private vacant land identified in Valadares

Municipalities in most countries are local planning authorities as promulgated by the various town and country planning acts. As local planning authorities, the municipalities have powers and functions to plan and implement local development plans, including enforcement of development control. Furthermore, municipalities have the power to specify or formulate development policies through by-laws. As policy-making bodies, municipalities therefore determine and shape the process of development at the local level. It is therefore within the ambit of municipalities to promote or prohibit urban agriculture.

A policy framework for urban agriculture would encompass planning policies, legislation and regulations that guide or regulate land use planning and management. However, in most cities, urban agriculture is ignored, not addressed in national and municipal policies or is not acknowledged as a valid urban land use. And when regulations or by-laws on, or related to, urban agriculture exist, this is often not under an overall and clear policy, and the law may be interpreted differently by different actors (Foeken, 2006).

One could however question the need for a specific policy on urban agriculture, and argue that urban agriculture rather should relate to existing agricultural, land use or environmental policies (Wolfgang, 2002). These policies however should then still set out objectives of equity entitlements to food and other urban area resources, principally land and water, so as to accommodate these for urban agriculture.

Whether urban agriculture is specific or not, in considering appropriate planning and policy measures, one needs to distinguish between profit-driven (and often capital-intensive) urban agriculture on the one hand and more subsistence, for-food, and largely informal urban agriculture on the other. The for-food urban agriculture tends to address the household food security aspects largely with very little emphasis on the economic aspects Policies on or related to urban agriculture should be aimed or related to the following issues:

- pro-poor poverty reduction;
- local economic development;
- environmental management;
- integration of disadvantaged groups;
- promotion of participatory governance and democratic cities.

The most relevant urban policy areas to urban agriculture are (see also chapter 1) those on land use, public health, environment, social (& economic) development and food security.

Land use

The key issues here, especially for informal urban agriculture, are the recognition of urban agriculture as an official urban land use, access to land and other resources, and security of tenure. Most municipalities either have city development structure plans, strategic plans or city development strategies, but most of these plans fail to take urban agriculture into account.

The policy instrument that can be used to achieve the objective of integrating urban agriculture into urban land use planning is urban land use zoning (see also the last section of this chapter). Layout plans could indicate the areas within the city in which urban agriculture is allowed, including guidelines from planners on types of urban agriculture. In Botswana, the City of Gaborone has set up poultry zones on land considered of low potential for development of other land uses (Ministry of Agriculture, Botswana, 2006)

Other policy options include the temporary use of vacant public and private land for urban agriculture. Municipalities could, for example, allow undeveloped land to be used for urban agriculture, subject to negotiation between the owner and the user. Further, municipalities have the option of promoting multifunctional land use. This could be done through encouraging community participation in the management of open spaces, where food can be grown in combination with other urban functions such as recreation and city greening. The case of Rosario (Lattuca et al., 2005) highlights this approach.

Health

Most cities have used the potential health risks of urban agriculture as a justification for prohibiting it. And indeed, urban agriculture, like any other industry, has potential risks for human health (see also chapters 8, 9, 11 and 12). But most of these potential negative effects can be minimised when urban agriculture is acknowledged and subsequently properly managed. Municipalities should develop and implement policies that minimise health risks without compromising the food production needs of the urban poor. For instance, in Cuenca in Ecuador, the policy thrust has been to regulate use of chemical fertilisers and pesticides in urban areas, to promote training and exchange on ecological farming practices, to provide licenses and incentives (eg. tax reduction) to micro-enterprises that produce and supply ecologically-friendly inputs (compost, bio-pesticides, quality seeds etc.) and to promote secure hygienic conditions for crop handling, food processing and vending of food.

Environment

There are several positive effects of urban agriculture on the city environment, but as with health, proper management is necessary to mitigate potential risks (see chapters 8 and 9). In this chapter the example of linking to Environmental Management Plans (as in Dar Es Salaam) is given. Urban agriculture can also assist to reduce environmental pollution through the recycling of solid and liquid waste in the process of agricultural production. For example, the City of Harare irrigates pastures on three large-scale commercial farms, which support over 10,000 cows, using wastewater from its Crowborough and Firle sewer works. The water filters down and eventually finds its way back to the city reservoir after a natural purification process (Toriro, 2003).

Social development

Urban agriculture is a sector that integrates the urban poor and unemployed into the urban economy. In so doing, it contributes immensely to feelings of higher self-esteem and safety among the urban poor. Urban agriculture has started receiving finances through regular municipal or state / national subsidies or financing mechanism. The mayor of Kampala has set aside a budget for urban agriculture, having realised its important social dimension (Makumbi, 2005)

Urban food security

As was stated in the introduction, most municipalities have no food policies, in spite of the increasing problem of urban food insecurity and growing urban poverty. Current trends regarding urban food insecurity in municipalities reveal that reliance on food produced in the rural areas is not sufficient, especially for the urban poor (FAO, 2001). Despite food being a basic human need (and right), urban food security issues are low or not on the agenda of municipal policy makers and planners. Putting urban agriculture on the agenda and integrating it into urban planning, should be done by giving attention to urban food systems (availability and origin of food and linking to the rural areas around cities). It is therefore recommended that municipalities should make urban food security a policy issue and develop plans to enhance food production in the urban and pen-urban zones. The Vancouver Food Policy Council (see chapter 2) is a good example.

International development programmes

Apart from issues at local or municipal level, further linkages should also be sought with international perspectives and programmes, which can stimulate or facilitate attention for and integration of urban agriculture in urban development. By flagging important international support and institutions that are supportive of urban agriculture, local policy makers are more likely to be responsive to set up local programmes. This responsiveness can be consolidated through exchange programmes, collaborative research as well as co-funding of research and pilot projects. Some contemporary programmes are mentioned below.

The *Habitat Agenda* was first drafted in 1996 in Istanbul, Turkey. It constitutes a new social contract towards improving human settlements in the world. It is a reaffirmation of the commitment to better standards of living and improvement of quality of life in human settlements. It highlights the role and importance of local authorities and of a wide range of other interested parties in the struggle to improve human settlements. The Agenda makes specific references to urban agriculture and has several issues it can relate to.

The *Millennium Development Goals* inspire and motivate agencies and countries to work towards a common goal. They raise and maintain public awareness in rich countries, thus maintaining political pressure for aid spending and effectiveness. They can also enable citizens of partner countries to compare their progress with others. The MDGs provide an opportunity to link urban agriculture with world development goals (especially goal 1, 3 and 7 and 8.

The *Special Programme on Food Security (SPFS) of the United Nations Food and Agriculture Organisation (FAO)* is a multi-disciplinary programme aimed at promoting an integrated and participative approach to food security. In addition, the FAO committee on Agriculture recommended the development of an organisation-wide programme on urban agriculture, now one of the Priority Areas for Inter-disciplinary Action (PAIA), “Food for the Cities”. Under this programme, FAO has started urban garden allotments in several cities.

The *United Nations Habitat NEPAD Cities Initiative* captures a strategic operational approach in addressing the urban challenge in Africa, by emphasising development and the environment. It is based on a broad participation of public, private and community groups, and concerned with inter-sectoral and inter-organisational aspects. It relies on bottom-up and demand-led responses and on local capacity building. Urban agriculture is listed as a relevant and immediate livelihood strategy in times of conflict and disaster.

The *Environmental Planning and Management Process* (EPM) is based on the premise that achieving sustainable development requires all actors to recognise the interconnectedness of the environment and development activities. It has been popularised by the United Nations Environment program UNEP in partnership with UN Habitat, and applied in their Sustainable Cities Programme. It became a framework through which cities could implement the Local Agenda 21 and the Habitat Global Plan of Action. The Dar es Salaam Sustainable Cities programme has modelled its planning around the participatory approaches of the EPM process (see box 3.4). The *Local Agenda 21* promotes development of action plans for sustainable development by local authorities jointly with stakeholders and citizens. It provides planning guidelines, incentive grants, training workshops, seminars, and promotes exchange of experiences in drafting local policies and action plans.

Box 3.4 *Integration of urban agriculture into urban planning- the case of Dar es Salaam*

In 1992, the city of Dar Es Salaam adopted the Environmental Planning and Management (EPM) approach in its City Consultation. This new approach has been the engine of change in many aspects and also related to urban agriculture. Under this new approach the city held a mini-consultation in 1993 to deliberate on agriculture. In the consultation, stakeholders agreed that agriculture in the city contributed substantially (almost 30 percent) in household food supplies and that it had become an integral part of urban livelihood strategies. A Working Group was formed to work out strategies for putting urban agriculture on the city agenda. The Working Group used a participatory approach to come up with a strategic plan on urban agriculture for the city.

The results of this process are good: from action, plan preparation, implementation of demonstration projects and further integration of agriculture in the city's urban zonification. Findings of the working group included results of these projects and were a basis of deciding on where and to what extent agriculture can be practised in the city as reflected in the Strategic Urban Development Plan (SUDP). In this plan, special land zones have been designated for agriculture. Ideas necessary for revising municipal by-laws and regulations were also worked out and a platform for coordination established and enhanced. The SUDP also has deliberately set apart several areas to be used for large- and medium-scale urban agriculture in the future and gives corresponding development conditions. This is contrary to the earlier "zonification" where an area could only be considered for agricultural activities while awaiting to be assigned other to uses such as residential or industrial areas. The major difference is that the Master Plan considered UA as a transitional land use whereas the SUDP considers it to be an important activity with a very important contribution to its citizens. Recognition is reflected in several laws and regulations, among them are the Agricultural and Livestock Policy (1997) and the National Human Settlements Development Policy (Jan 2000).

There is no one single way of organising urban agriculture and success very much depends on adaptation to local conditions. In Dar Es Salaam, it is seen, that agriculture can be effectively integrated in urban land use plans.

Adopted from Martin D. Kitilla and Anasteria Mlambo, 2003, Integration of Urban Agriculture in City Development in Dar es Salaam

Poverty Reduction Strategy Papers (PSRPs) are prepared by member countries through a participatory process involving domestic stakeholders as well as external development partners, including the World Bank and the International Monetary Fund. A review of most of the PSRPs shows that they do not take into account urban agriculture as a strategy for poverty reduction (yet)!

HIV/AIDS and urban agriculture

HIV/AIDS has emerged as on of the foremost challenges for development and poverty alleviation. Sub-Saharan Africa is home to nearly 30 million of the world's 42 million people living with HIV and AIDS. Local governments have been called upon to address the HIV and AIDS problem seriously. Urban agriculture might provide an opportunity to do something positive for people infected and affected by HIV/AIDS. Governments should provide land and waste water resources that can be used to boost the nutritional status of sufferers and their dependants. Medicinal plants can be readily grown and harvested within the local environment. Self- employment in home and community gardens may strengthen self esteem (see also box 3.5).

Box 3.5 *HIV/AIDS and urban agriculture in Botswana*

The Ministry of Health in Botswana has a National Nutrition Plan of Action which uses urban agriculture and is designed to provide guidelines for the government, acting in partnership with NGOs, the private sector, local communities, and families. The ministry intends to use urban and peri-urban agriculture to improve nutrition, by provision of foods that are rich in essential nutrients to HIV/AIDS affected households. The promotion of urban agriculture is also more urgent especially considering the increasing number of orphans due to HIV/AIDS pandemic. It should be noted that urban poverty is worse than in the rural areas where in most cases the family support systems still exists. The ever-increasing cost of living also impacts heavily on the urban poor, especially the women who bear the heavy burden of providing care for the aged, disabled, orphaned, sick relatives and to a large extent to HIV/AIDS patients through the home-based care programmes.

Adopted from: Urban, Ministry of Agriculture, Botswana, 2006

Access to land

Urban farming requires some land space, whether the farming system is soil based or not. Land is one of the most controversial issues associated with urban agriculture, referring to the issues of secure tenure and conflicts over use of scarce urban land, water and other resources. Since the other chapters in this book deal with other resources, the emphasis here is on land. Land for urban agriculture is either not available, or when available it may not be accessible, and when accessible it may not be usable for a particular form of agriculture (Mushamba et al., 2003).

Availability

In most cities and towns there is a high demand for land for residential, commercial and industrial development, among others. The productive or potentially productive areas of the city that have not been paved over are not limited to communal farms and private gardens. In many cities such as Accra, Ghana, Setif in Algeria, Divo in Ivory Coast (See for instance, the Urban Agriculture Magazine Number 11) a lease for agricultural use of the land is only given for one year, because of claims for other uses. This makes availability of land, and other resources associated with land such as water, a great concern for the urban farmer.

Institutional land areas (belonging to hospitals, schools, and churches), riverbanks and roadsides, parks, lands under high-voltage electrical towers that cannot be used for buildings and those surrounding refuse dumps make up much of a municipality's territory. Planning the use and exploitation of these spaces requires mapping their location as a first step and then assessing their potential. It is important to assess the availability of land for urban agriculture in a given city in the short-, medium- or long-term period. Land may not be available due to rapid development of the built-up environment.

Accessibility

Land may be available but not accessible because of social or political reasons. Accessibility relates to the opportunity for the actual utilisation of available land by needy households or groups, taking into account administrative procedures and conflicts that may arise. Access may refer to the land itself or the use of the land. Often the ownership and tenure patterns are not known because of lack of records or frequent change of hands. Traditional forms of ownership as under customary law also exist (see the case on Abidjan). Land may also be far from where farmers live and public transportation and roads could be inadequate or not available. Available land may be too costly for farmers to rent. Farmers may not have the social or political connections necessary to learn about or gain access to the plots that are available. The poor and recent migrants in cities often lack access to land for urban agriculture. Planning policies and legislation that deem urban agriculture as an illegal activity can prevent farmers from accessing land. Discrimination by gender may prevent equal access by men and women.

Usability

The usability of available and accessible land is determined by factors such as topography, size of plot, soil texture and quality, availability of water and security of tenure. Also, services such as water for irrigation and inputs or market facilities, transportation infrastructure are factors that determine a plot's usability. In Rosario (Dubbelling, 2003) the following variables are used to define the suitability of the land: environmental quality; potential agronomic use; actual use (and previous use if the area has been used as a dump or for other hazardous activities); current regulations for land use; urban and city projects planned; water supply; ownership; and population groups interested in agriculture.

Box 3.6 *Accessing land for UA in Kampala*

Since the early 1970's, the urban population of Kampala has grown considerably and an increasing number of vulnerable households have turned to urban cultivation as an alternative source of food, as a means of saving on food expenditure, and as a way of generating cash income. Of the city's population of nearly 1.5 million inhabitants, 40 percent consume either a crop or animal product produced in the city, while 70 percent of all poultry products consumed are produced within the city (Ssebaana 2002). Agriculture in Kampala is practised mainly in valley slums where the poor live in informal settlements. Although urban agriculture offers easy access to services and markets, gaining access to land to grow food and rear animals is a challenge for the urban poor.

The majority of the poor gain their access to land as customary tenants on privately owned land in periurban areas, a form of land tenure unique to Buganda known as bibanja (plots) on mailoland. Many poor people who lack land ownership rights gain access to land in poor areas like wetlands, road and railway reservations or waste disposal sites, and grow annual crops. Others utilise their backyards or encroach on undeveloped land left to fallow by landowners. Despite being squatters, the poor have usufruct on the plots they farm. Landlords and city authorities do not allow squatters to grow perennial crops, and the poor squatters stand to be evicted at any time if the occupied land is going to be "developed".

A research undertaken on how the poor access land for urban agriculture revealed different modes (Nuwagaba et al, 2003): squatting (46 percent), borrowing (34 percent), inheriting (11 percent), renting (5 percent), co-owning with spouses (4percent). Currently in Uganda, the spouse co-ownership of land is a contentious issue particularly among gender activists who contend that women have for long been left out from the benefits of family resources. The majority of urban farmers in Kampala (60 percent) indicate that they are actively searching for land, and mention plans to borrow from the government or relatives, or seek funds to buy.

Adopted from: Kiguli et al., 2004

Incentives for producers to invest are compromised by the lack of security concerning land tenure and the fear of eviction. Why erect terraces, improve and fertilise the soil, or build irrigation reservoirs if the government does not guarantee that benefits can be reaped from those investments? Taxation rules and legal frameworks are therefore necessary to provide security and incentives for producers.

Land tenure

Security of land tenure is very important, but hard to get for urban farmers, especially for those farming off-plot (on plots away from the homestead, like open areas in the city) or in peri-urban areas. Land tenure refers to the system of rights and institutions that governs access to and use of land and other resources on that land. It determines who can use what land and how. It derives from both statutory and customary law. Research on land tenure suggests that the most apparent qualitative linkage between tenure and food security is that increased security of tenure in productive resources enables more efficient and profitable production and hence greater access to food products.

Land tenure determines the level of investment that urban farmers themselves put into projects. The private sector is often not willing to advance loans to urban farmers as they lack legal rights to land and are therefore unable to use it as collateral. The tenure situation of women is even more precarious (MDP-FAO, 2001). Administrative arrangements for secure tenure are cumbersome and proper registration of plots and users is often non-existent. However, (temporary) user permits have been successfully negotiated in some countries concerning leases for public and private land for specific periods of time with clear conditions as is highlighted in the cases.

Implications for urban planning and management

Improving the availability of suitable land for urban agriculture is important. Urban agriculture therefore should be included into official land use categories, statistics and surveys, so as to inform urban local authorities. Geographic Information Systems (GIS) could be used for registration purposes, for improving land use monitoring and evaluation activities, and as a basis for a transparent taxation system. The case study of Rosario highlighted in chapter 2 created a land bank, where land was categorised by type and those areas where UA could take place were identified. Governador Valadares (see case) included urban agriculture in their master plans and made sure that land was made available for the activity. In Gaborone in Botswana, special poultry zones were created around the city. Dar es Salaam also has zones where livestock is raised. The case study of Beijing highlights the impact of zoning in making land available for urban agriculture. A study by SWEDEPLAN highlights that in Sweden many housing developers are now incorporating compositing and kitchen gardening into designs and layouts for housing projects (Greenhow, 2002). Green houses are allowed on the walls of apartments facing the south. In housing schemes built in the 1960's where redevelopment is taking place, compositing facilities and space for gardening are being provided. (ibid).

Branko Cavric

Training of Urban Planners in Gaborone, Botswana

Municipal land use plans need to be studied to determine if spaces can be allocated for cultivation, aquaculture, animal husbandry and forestry, among other activities. Depending on the country, these municipal plans can be part of strategic plans, urban development plans, or land use plans.

Integrating Urban Agriculture into National and Municipal Policies

Policies related to urban agriculture can be categorised in the continuum from full endorsement and facilitation to regulation or outright prohibition. Under the more restrictive policies community concerns are ignored. Urban agriculture is not permitted, regardless of the desires of the community. These policies are characterised by restrictive legislation, lack of flexibility or room for innovation, resistance to change within the local authority and rigid adherence to rules. On the contrary, enabling or endorsing approaches are found when authority, statutory powers and other frameworks are used to assist, advise and guide communities on the way forward for urban agriculture; community concerns are given attention; and innovation and new ideas are encouraged.

Most current legislative frameworks do not facilitate urban agriculture, but leave room for flexible interpretation. In Nakuru, Kenya, Foeken (2006) shows that the laws, both national and local, tend to restrict urban agriculture, but that the practice is tolerated in the city. Most laws and by-laws are archaic and have been borrowed from the colonial days and are therefore not in keeping with the design and activities that take place now in cities of the developing countries. Legislation should therefore be crafted so that it supports promotion and regulation of urban agricultural activities.

Promoting urban agriculture at local and city level includes lobbying with different stakeholders at different levels, including the Municipality, NGOs, Departments of Lands, Agriculture, Food Security, Health and Local Governments and farmers, providing them with targeted information and best practices.

Box 3.7 *Legislative framework for urban agriculture in Zimbabwe*

An audit of the policy and legislative framework for urban agriculture in Zimbabwe was undertaken by the Zimbabwe Environmental Law Association (ZELA) and the Municipal Development Partnership of Eastern and Southern Africa (MDP) from December 2003 to February 2004. The main objective of the audit was to identify relevant and current policies and legislation which impact on urban agriculture and to provide recommendations on how current legislation can be reviewed in order to develop an enabling legislative framework.

One of the key findings was that indeed there is not one but many pieces of legislation that impact on urban agriculture in Zimbabwe, both at the national and the municipal level. There have not been any recent regulations or by-laws gazetted to the effect of regulating urban agriculture in Harare, Zimbabwe. It was also found that legislation does not refer to urban agriculture per se, but to farming in urban environments. The different types of legislation and the absence of the term urban agriculture in such legislation, coupled with misinterpretation by those who enforce the law, leads to confusion on the legal standing of urban agriculture.

The research also established that in what is seemingly a very prohibitive environment, there are indeed many opportunities that exist in legislation for the practice of urban agriculture, contrary to popular belief that the law prohibits urban agriculture in Zimbabwe. Urban agriculture has grown in importance, but is still considered as a rural activity in the law. Existing law seeks to regulate the practice of urban agriculture so that the negative effects can be prevented, and when they do happen, that prompt relevant action can be taken.

From: Mushamba and Makonese, 2004.

National government interventions

National policies determine activities or local policies promulgated by local governments. On the other hand, local authorities can lobby national governments to make policies which may then be adopted at national level. By-laws are made by local authorities and are only applicable within the jurisdiction of that particular local authority. (Makonese, 2005) Outsiders cannot be bound by these rules as long as they are outside the jurisdiction of that local authority. By-laws however should not be ultra vires national law. If they are, they become illegal and are not enforceable to the extent of the inconsistency. A policy is a broad operational framework (a way of doing things) for an organisation, institution or a country. Policies are statements of good intentions and are not legally binding. They therefore cannot be enforced in a court of law but only have persuasive or normative value. However, policies can result in the enactment of legislation or by-laws if it is deemed necessary.

The process of enacting laws and by-laws is generally long whilst policy development is fairly easy. It is for this reason that most cities and countries have chosen for policies on urban agriculture. Several platforms are available for convincing policy makers to push for policies on urban agriculture. On the other hand, by using international development programmes, workshops and conferences it may be possible to lobby governments and local authorities, for example the Harare Declaration arising from a conference on urban agriculture and food security. It is also possible to target national agencies and players like local government associations and push through them the mandate for national policy change. Policy change follows practice.

National governments could possibly have a role to play in:

- The creation of an institutional home for urban agriculture by selecting a national lead agency on urban agriculture and the establishment of an inter-departmental committee on urban food production and consumption;
- The creation of an appropriate legal framework for urban agriculture;
- Stimulation of policy and action-oriented research on urban agriculture, including research on the functioning of informal networks in urban agriculture, technologies for safe re-use of urban wastes and waste water, space confined and water saving technologies, integrated pest management and other ecological farming practices, small scale food processing techniques etc;
- Facilitating awareness raising among city administrators, urban planners, technical departments and NGOs through seminars and workshops that provide them with reliable data and positive examples (“best practices”); and
- Co-financing of city urban agriculture programmes.

The Government of Tanzania for example has, since the 1970s, openly supported urban agriculture through clear policy statements, as a means of boosting a poorly performing economy and meeting the need for food self sufficiency. The government and political leaders have, time and time again, encouraged urban dwellers to grow crops and keep livestock in their backyards and in open spaces. Other countries are following Tanzania’s example as stated in the Harare Declaration on Urban and Peri-Urban Agriculture in Eastern and Southern Africa (see box 3.8).

Local government interventions

Local or municipal authorities can play a key role in enabling and regulating urban agriculture, amongst others by:

- Stimulating the dialogue and cooperation among the direct and indirect stakeholders in urban agriculture (see chapter 2).
- Reviewing and revising existing municipal by-laws and regulations regarding urban agriculture.

- Integrating urban agriculture into sector policies.
- Securing access to land and enhancing the security of user rights of urban farmers, among others by urban land use planning and zonification, provision of land, and the promotion of multi-functional land use.
- Promoting safe re-use of urban organic wastes and wastewater in agriculture.
- Stimulating enhanced support to processes of technological innovation in urban agriculture and promoting ecological farming practices.
- Facilitating local marketing of fresh, urban-produced food.

Box 3.8 *Harare Declaration on urban and peri-urban agriculture*

Ministers from local governments from Kenya, Malawi, Swaziland, Tanzania and Zimbabwe met in Harare, Zimbabwe, on Urban and Peri-urban Agriculture (UPA) in Eastern and Southern Africa organised by the Ministry of Local Government, Public Works and National Housing of the Government of Zimbabwe and the Municipal Development Partnership for Eastern and Southern Africa, in collaboration with UNDP, UNICEF, FAO-SAFR, FANRPAN, RUAFS and IDRC, on 28 and 29 August, 2003. They acknowledged that UPA is a widely practiced activity in and around towns and cities within the region on parcels of land with alternative competing uses. Consequently, UPA has generally been practised informally without appropriate policy, legislative and institutional frameworks. Therefore, UPA plays, and will continue to play, a significant role in promoting food security, employment creation and income generation, health and nutrition and improving the economies of urban areas. Some governments in the region have made significant progress in incorporating UPA in their urban development plans, and others are now beginning to rise to the challenge.

Furthermore, they recognised the existence and increasing practice of UPA and also noted the many challenges that it faces.

They therefore called for the promotion of a shared vision of UPA that takes into account the specific needs and conditions in the region, and accordingly committed themselves to developing policies and appropriate instruments that will create an enabling environment for integrating UPA into urban economies.

Adopted from MDP, 2003

Opportunities to integrate agriculture into urban planning

The most commonly used planning tools in shaping the urban environment include master plans, local plans, subject plans, site plans and neighbourhood improvement plans. When drafting these plans, planning policy is drafted simultaneously to accompany them. These plans guide the use of private and public land, community and individual health, public safety, circulation and transportation. The plan includes broad policy statements and detailed zoning of land uses, with associated by-laws or ordinances and regulations listed in supplementary documents. Urban agriculture needs to be recognised and included as part of a development strategy with subsequent allocation of land for it in municipal plans.

In most urban settlements, the **Master Plan** has become a statutory provision. The law stipulates that a master plan needs to be prepared to guide urban development in the medium term - often 10-15 years. The preparation process involves wide consultation and public display of the master plan report. The master plan makes land allocation on a broader scale with the typical generous provision for open space, green areas and recreational areas as a public good. But master plans are rather static and slow to assume change. Still, there is great potential in the master planning process for integrating urban agriculture into its goals and spatial development framework. The cases of Rosario and Cienfuegos in Latin America and Dar es Salaam in Tanzania highlight how urban agriculture can be incorporated into a city master plan.

Derived from the master plan, **Local Plans** are prepared for specific development zones. It is much more detailed and includes a layout of how the land will be allocated and demarcated. It provides the opportunity for integrating urban agriculture on-plot as well as off-plot, since issues of plot sizes, mix, densities, tenure etc. are dealt with in the local plan. The Human Settlements Policy of Tanzania has designated special areas, where people would be granted legal rights to engage in urban agricultural activities, at the level of the local plan.

In any spatial area, a **Subject Plan** may be prepared, to deal with specific subject matter, for example public transport, drainage etc. These plans are often prepared when there has been a major public problem. Opportunity exists for urban agriculture to be presented in specific areas through subject plans. Under the EPM approach adopted in Tanzania, a working group on urban agriculture in Dar es Salaam produced a subject plan on urban agriculture.

Site Plans are the lowest level of land use planning and concentrate on individual stands or plots. Site plans are used to position development activities within the stand. Site plans relate especially to on-site urban agricultural activities, where space should be left around the dwelling to allow farming.

Finally, one should also seek to integrate urban agriculture into for example neighbourhood improvement plans (informal housing areas/ squatter upgrading programmes), plot subdivision plans and urban regeneration/ renewal plans. In all these situations, scrutiny should be made of all land that can possibly be used for urban agriculture. This requires the involvement and lobbying of local urban agriculture interest groups (see for instance the case of Cagayan de Oro in the Phillipines in Box 3.9).

Box 3.9 *Building food-secure neighbourhoods, the role of allotment gardens*

Cagayan de Oro is one of the three model cities in the Philippines under the UN-Habitat Sustainable Cities Programme due to its efforts in addressing the challenges of urban environmental management and food security. This is particularly evident in its allotment garden programme, which enables multi-functional land uses such as food production and income generation, treatment and nutrient recycling of biodegradable household wastes and excreta, as well as open spaces for community and family activities.

The first allotment garden of Cagayan de Oro was established in 2003 (Holmer et al., 2003). Since then, the number has grown to five self-sustaining gardens located in different urban areas of the city, enabling a total of 50 urban poor families to get legal access to land for vegetable production. These allotment gardens are characterised by a concentration in one place of six to twenty small land parcels of about 300 m^2 each that are assigned to individual families, who are organised in an association. In the allotment gardens, the parcels are cultivated by individual families.

Aside from contributing to the food security of the community, the gardens are also essential for the successful implementation of the city's integrated solid waste management programme as mandated under Philippine law. In the city districts that have an allotment garden, the amount of residual wastes delivered to the landfill site has been reduced by more than one third since the segregated bio-degradable household wastes are converted into compost in the gardens. So-called ecological sanitation ('Ecosan') toilets have been recently established in four of the five areas. They serve as show cases for improved sanitation.

The city government of Cagayan de Oro is presently mainstreaming the allotment garden concept into its overall city planning and development, which will also use participatory GIS-based approaches to identify suitable areas for future garden sites. A city ordinance is presently being prepared to reduce taxes for landowners who make their land available for this purpose.

Adapted from: Robert J. Holmer and Axel Drescher, 2005

Table 3.1 *Integration of UA through various planning tools*

Level of Planning	How To Integrate Urban Agriculture	Planning Authority
Master Plan	· State-wide policies and goals for the planning · Designation of areas for urban agriculture by the city, municipality, town or board	Local Authority
Local Plan	· Create zones for urban agriculture within specific areas that are part of the master plan	Local Authority
Subject Plan	· Address issues of urban agriculture on a thematic basis	Local Authority
Local/Layout Plan	· Create a map indicating land for urban agriculture, among other uses · Show designated land in blocks and plots · Use by surveyors to peg urban agriculture plots	Local Authority
Site plan	· Indicate areas for urban agriculture within an individual plot or stand	Individual developers

Zoning land for urban agriculture

Zoning refers to the designation of land in a municipality to different related land uses and the regulation of the use of the land in those areas. Residential, commercial, and industrial are typical urban zones. Under zoning, regulations of the spacing of buildings, size (in terms of floor area or bulk factor) are included with the aim of conserving or promoting human health, safety and convenience. It is argued that zoning encourages urban agricultural activities to be undertaken (Ministry of Agriculture, Botswana, 2006, and in Kathmandu (Weise and Boyd, 2001). Zoning of poultry zones has been successfully used in the case of Gaborone (Botswana) as a strategy to encourage poultry production. The case of Beijing in China in regards to zoning has already been mentioned.

Geographic Information Systems (GIS) can be used for mapping land for urban agriculture, for registration purposes and for improving land use monitoring and evaluation. A methodology for mapping vegetable production on open spaces has been successfully implemented in Dar es Salaam, Tanzania. The mapping procedure comprised an analysis of aerial imagery, mapping in the field, and integration of the results into a GIS. The basic functions of GIS proved to be a very useful. Integrated in local government and planning processes, the GIS database can contribute to raise public awareness on the situation of urban farmers, help to improve extension services, and can be used by town planners for further analysis and planning purposes. (Dongus and Dresher, 2001).

Plans and Standards

To stimulate UA, enhance its potential and facilitate its integration into urban development, municipal land use regulations that accompany the produced plans should clearly spell out urban agriculture as a legitimate land use. Standards for layout planning need to be developed on land size that considers agricultural production around the house. For example, standards already exist for the size of schools, open spaces, and roads per thousand inhabitants. Improved standards for community or neighbourhood gardens in dense areas and community or neighbourhood gardens together with private gardens in less dense gardens should be part of the plan formulation process. Further, specifications should be made for the types of activities that are permissible in given areas.

Housing standards have been a subject of long discussion and debate. Minimum plot sizes have been revised upwards and downwards over time. There is a need to understand housing as a multi-functional space for production, reproduction and socialising, and not just as a place to sleep (Jarlov, 2001). In those cases where the (high) price of serviced land is used as an argument against bigger plot sizes, un-serviced off-plot land for urban agriculture should be identified. The case of Mbabane in Swaziland (Greenhow, 2002) highlighted the negative effect of the continued reduction of residential plot sizes on urban agriculture activities. Plots should be large enough to allow on-plot urban agriculture to take place. This will be influenced by the set-back distances of dwellings from neighbouring boundaries. If the plot is too small or the dwelling is designed in such a manner as to cover the entire plot, then there will not be enough land for cultivation.

Lena Jarlov

Women in a township in New Brighton, South Africa have invited a councillor to ask for gardening land.

Indirect planning tools

Indirect planning tools are used to regulate land use on land that is privately owned. This is done by permitting certain uses or by prohibiting other uses. These measures are often accompanied by stimulation in the form of information and incentives, including tax incentives or exemptions, environmental impact assessments and subdivision control. Subdivision control, particularly for peri-urban land, ensures that encroachment by land uses other than UA is controlled. Tax exemptions can be introduced for land that is made available for urban farming. Licences can be granted to the public at nominal rates for land to be used for urban agriculture (see also chapter 4). In Rosario, Argentina, land under urban agriculture attracts a lower property tax whilst in Valdares, Brazil, community urban agricultural activities are exempt from water tariffs through an association of urban agriculture and community farming. (RUAF, 2005). In the latter, the exemption is for a given quantity of water in accordance with the profile of the activity. In case the user does not carry out UA according to standard practice, the penalty will be to return to the public treasury an amount of money equal to the reduction in tariffs.

Urban agriculture by its nature has more direct effects at the local than at the national level. Even at the local level, the extent to which the practice can influence issues will also differ among local authorities depending on the nature, size of the city and the standard of living of the people within the local authority. Local authorities will therefore respond to the issue of urban agriculture at various levels through the use of different instruments. The current situation in most countries is that there are more by-laws that deal with the issue of urban agriculture in a more meaningful way than laws that are made at the national level (eg. Regulations or Acts of Parliament.) Even then, the by-laws that are in place do not deal directly and concisely with the issue but approach urban agriculture from a different perspective, regulating activities that have a bearing on urban agriculture rather than regulating the practice of urban agriculture itself. It is therefore important that national laws which recognise urban agriculture are promulgated at national level.

Conclusions

This chapter argues that the multiple functions and relation to other urban issues offer sufficient reasons for the integration of urban agriculture into sustainable urban development. Urban planning and design regulations are needed to facilitate this integration. However, planners do not make decisions, they only recommend them. The urban planner operates in an institutional environment that is at the centre of diverse political interests. The fact that urban planning officials are accountable to politically-elected councillors, most of whom have no relevant urban planning and management expertise, restricts development of innovative ways for integrating agricultural activities into the urban land use system (Chaipa, 2001). In addition, there is often limited capacity to enforce planning regulations with many other actors involved in enforcement, e.g. municipal police, courts, politicians etc. Furthermore, most practising planners are content with observing the status quo by implementing development control according to laid-down procedures, standards and provisions for legislation such as the Urban Councils Act. A critical shortage of skilled planners also hampers innovative and responsive planning (Chaipa, 2001).

Cities require an enabling policy framework to guide the enhancement of urban agriculture. This framework should have adequate legislation to enable access to land and guarantee rights for farmers. Institutionally, the framework should acknowledge that urban agriculture falls under the jurisdiction of several different levels and types of authorities, eg. agriculture, forestry, parks and gardens, public works and urban planning.

Shingirayi Mushamba

Demonstration plot at Musikavanhu Urban Agriculture project in Harare

Coordination and information sharing are important, as is its integration into other municipal developmental projects. Integration of urban agriculture into programmes dealing with MDGs, HIV/AIDS and poverty alleviation is important. The draft policy paper on UA in Botswana highlights the linkage between UA and HIV/AIDS.

Some of the innovative techniques such as land banks, participatory planning and long-term leases for land used for UA activities are beginning to address concerns of ensuring adequate access to land and other resources for UA by the urban poor and should be encouraged. To the extent possible, GIS should be used for registration purposes, for improving land use monitoring and evaluation activities, and as a basis for a transparent taxation system. Incentives in the form of local tax reductions, tariffs and promotions for urban agriculture should be encouraged.

Urban planners have an active role to play in integrating urban agriculture into urban planning, especially in encouraging it as an urban land use, and in catalysing change in the public perception. The cases discussed in this and the other chapters of this book demonstrate that it is possible to integrate UA into urban planning and come up with regulations that reinforce this. Such regulations have more chances to succeed, if they are permissive instead of prohibitive. The successful and sustainable integration of urban agriculture into urban land use systems is a complex task requiring a multi-stakeholder approach (as was outlined in chapter 2). The urban planner can and should take a leading role here by creating a conducive operational environment. Urban agriculture stakeholder forums, formed by stakeholders including planners, farmers, producers and representatives of various agencies, can be very useful for developing shared vision, resolving conflicts and developing joint action programmes. Urban planners are well positioned to change the views of politicians, other municipal staff and the public about what is appropriate urban form and function, and what activities are suited to the urban area. This requires intensive public and political awareness raising and good urban governance.

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Land Availability for Urban Agriculture in Abidjan, Cote d' Ivoire

Moussa Sy

This text is a synthesis of a research report (in French) on urban agriculture and land use carried out in 2002 by the national coordination in Ivory Coast: Bureau National d'Etudes Techniques et de Développement (BNETD) of the Francophone Network on Urban Agriculture in Central and West Africa (RFAU/AOC)

Abidjan is the economic capital of Cote d'Ivoire and is located on the shores of the Gulf of Guinea, about 550 km from Accra, 1,300 km from Bamako and 1,150 km from Ouagadougou. The city is important to the West African economy with its seaport serving the neighbouring countries of Burkina Faso, Mali, and Niger. Abidjan and its suburbs cover an area of 137,000 hectares, of which 58,000 are occupied by the town itself and the remaining 79,000 by the peri-urban districts of Bingerville, Anyama, Bassam and Songon. The city grows by about 450 to 500 hectares in its peri-urban areas every year (ASDA: Abidjan Urban Master Plan, 2000). Hundreds of hectares being used for agriculture are confiscated and indemnified every year by either the State or by private investors. Therefore, the competition for the use of land for agricultural and non agricultural activities is high. Land access constitutes one of the main preoccupations of peri urban agricultural producers.

Moussa Sy

Urban Agriculture plots along the main roads

Abidjan's population has grown from 2 million inhabitants in 1988 to 2.5 million in 1993 and was about 3 million in 2001. The current average population growth rate is about 3.8 percent. It is estimated that about 800,000 working people of Abidjan are involved in urban agriculture, or more than 3 percent of the total population. Nearly 70 percent of these agricultural producers are between 25 and 35 of age, explained by the high unemployment rate in Abidjan and consequently the importance of urban agriculture. In addition to supplying fresh produce, peri-urban agriculture contributes to poverty alleviation by employing at least 3 percent of the active population in Abidjan. Furthermore, urban producers make urban sites attractive and contribute to improvement of places such as the shores of the Cocody Bay (coast road) and the Boulevard de Marseilles, as well as the east side of Hotel du Golf at M'pouto.

Despite these advantages, urban agriculture is not legalised. Urban land legislation has been developed to cater for housing, but not for agricultural activities. Access to land in Abidjan is therefore an obstacle to the development of urban and peri-urban agriculture.

In relation to the development of urban and peri urban agriculture, the actors who have a stake in land tenure / ownership in Abidjan can be classified into four categories: the state of Cote d'Ivoire - the "official owner" of all the country's land -, represented by the Ministry of Construction and Urbanisation, Ministry of Agriculture and other institutions as BNETD and AGEF (Agence de Gestion Foncière); traditional land owners belonging mostly to the ethnic group of the Ebriés; private investors (housing promoters, multinational firms, etc.); and private individuals, who are small urban land owners.

Land management

Land scarcity and the increase in the number of producers has generated a strong pressure on the availability of cultivable lands and resulted in several land disputes, in the past years. The need for housing is pressing in Abidjan. Nearly 20,000 houses are built every year, which requires about 670 hectares of land per year[1]. Next to the major land owners mentioned above, the inherited land, generally, is the property of the community and is under the responsibility of the village chief. But in the face of important financial interests related to land, some heads of families manage their properties in a more and more individual way. A majority of the land disputes can be linked to the land management approach of village owners.

Box 3.10 *Typical urban producer in Abidjan*

According to the 2002 survey, the average urban producer working in the peri urban areas of Abidjan is a male, is not from Cote d'Ivoire, in his thirties, and is married and with a family of about 8 people. He has been practicing agriculture for ten years and has a low level of education (below primary school level). His main crops are manioc or vegetables, but he also engages in cattle rearing and horticulture. He markets his produce locally and has an average monthly income of 50,000 francs. He doesn't benefit from any financing for his activity and is a tenant on the land he cultivates. He experiences great difficulties to access land. He uses chemicals and fertilisers in his activity and has little awareness of the health hazards linked to their use.

The State owns land registered under its name and land that is not registered under its name. There are three strategies to appropriate land:

- direct use of registered land which has not been allocated to any use;
- expropriate for public interest reasons land that is registered under the names of private individuals;
- purge of customary right on non-registered land (the management of which lies with traditional chiefs).

Virgin lands including the areas where peri-urban agriculture is practiced represent 66percent (67 700 hectares) of the non built-up areas of Abidjan. These areas constitute an asset for the long-term development of peri-urban agriculture of the town, but the practice is that these lands will be quickly absorbed by housing areas. In the non built-up areas (within the town) the agricultural sites generally represent illegal occupations of land reserved for housing and infrastructure. They are hardly accounted for, and this makes it difficult to estimate the land occupied by agriculture, particularly in urban areas.

The impact of land management on the development of urban and peripheral urban agriculture depends on whether the producer is the landowner or not. The study reveals that 57 percent of the producers questioned are not the owners of the land they use. Many of the traditional chiefs of Abidjan's peripheral urban area rent lands to agricultural producers. The producers and the landowners are generally bound by a "moral contract". In the absence of a legally binding contract, the village landowner may at any given time of the year ask the producer to return his land. Thus, morally binding contracts and /or non-certified sales deeds on non-declared lands makes it difficult to obtain a legal document from the administration (land deed) and makes the producers' land ownership even more precarious. However, selling to private investors seems more profitable than renting land to agricultural producers.

Land legislation and appropriation strategies

The Land Act of 1998 does not feature urban agriculture. Laws developed in relation to land and agriculture deal with the rural areas. Disputes related to land legislation have always existed². The legislation of Côte d'Ivoire is complex. Since the colonial period, several statutory orders and decisions signed by Ministers and Governors of the French West African Colonies (A.O.F) have allowed colonisers to take possession of the land and facilitate the activities of foreign agricultural planters. But regardless of the period in which these acts of law ruling land were passed, the traditional land owners remain the most important group.

A study of the urbanisation master plan of Abidjan and its suburbs, a census of projects in the peripheral urban areas and urban areas, and a study of the existing agricultural sites shows that the municipality could have been more proactive in the allocation of non-used urban land for agricultural activities. The agricultural areas that are located inside the town are numerous and have an average size of 1000 m^2. The majority of such sites are found in the town's peripheral urban zone. These sites count individual producer plots (manioc, maize, yam, vegetables, etc.) as well as big industrial plantations (coconut, palm and pineapple groves, hevea, etc.). The study shows land reserves for short-term agricultural projects (2 to 5 years), which cover 27,414 hectares, and reserves for long-term projects (5 to 15 years) of 67,600 hectares.


Moussa Sy

Dificult to estimate the land occupies by agriculture

The majority of urban producers encounter difficulties to access land, particularly the migrant farmers (who represent more than 5 percent of the total producers). This demand for land is higher within the town than in the peri-urban areas.

The low income of the majority of agricultural producers in combination with the strong demand for land creates a permanent threat of expulsion and sense of insecurity for the land users. Landowners lease their lands to agricultural producers in the hope of "brighter days" when richer private investors would buy the land or when they would sell parcels to a new housing programme.

The present administrative procedure for land access is in itself a factor of exclusion, considering that a considerable number of the agricultural producers are illiterate. Seventy five (75) percent of the producers who encounter difficulties in accessing land have an education that is below primary school level. Also the number of years of experience in agriculture is important. Those with more than 10 years of experience encounter less difficulties in accessing land.

Apart from land shortage, other factors too make land access difficult for producers in the peripheral urban area:

- insufficient attention paid to the need for agricultural land by the Ministry of Urbanisation;
- preference of village landowners to sell their land to private investors for financial reasons;
- limited financial capacities of small producers;
- expulsion threats to producers that spontaneously occupy listed land or land that is inappropriate for construction.

Spontaneous and illegal land occupation is the most practical response of producers to their difficulties to access land. Some examples are the occupation of the "Parc des Expositions" by market gardeners of Port Bouêt, or the land belonging to CI – TELCOM (Côte d'Ivoire Telecom) at Marcory "Sans Fil". The gardeners contribute to cleaning of these areas, but in the end, face a continuous threat of expulsion by the State and / or the municipal authorities. Landslides due to improper management of steep slopes and road accidents when close to important traffic networks are also problems caused by spontaneous and illegal land occupation.

The urban producers interviewed, foresaw enormous improvements if the municipal authorities or the Ministry of Constructions would provide access to appropriate land on a permanent or temporary basis. In addition, more simplified administrative procedures are needed to get title deeds for these lands. There is also a need to provide information on the current situation to the main actors, especially the institutions in charge of urban planning.

Land prices in Abidjan vary according to location. Considering their endowment in infrastructure (accessibility, clean water supply, public electricity, public transport) the renting or selling prices of land within the town are high (from FCFA 3,500 to 100,000 per m^2). Land located in the peripheral urban area without infrastructures and without a definite administrative status has relatively lower renting or selling prices. More than 80 percent of tenant producers pay less than FCFA 35,000 per month. In the peripheral urban area landowners sell their land between FCFA 500 and 2500 per m^2.

Conclusion

Access to land is one of the main concerns of urban producers. The majority of peri-urban producers (63 percent) encounter difficulties in accessing land. It will be important to formulate municipal action plans and to jointly find solutions to land issues related to urban agriculture. Some suggestions are to:

- Organise awareness campaigns for agricultural producers, especially women, for example on the procedure for acquisition of land deeds;
- Facilitate access to finance for agricultural producers;
- Encourage the producers to form cooperatives;
- Improve individual access to land;
- Sensitise consumer associations on quality control of urban agriculture production;
- Improve the capability of municipal authorities in land administration.

Notes

[1] Hypothesis for calculation: for a low to middle income standing housing area, we consider on average 60 percent of the land allocated to house constructions, 15 percent for roads and 25 percent for infrastructure. Considering an average of $200m^2$ per house, this represents 400 hectares for houses. 40 percent of the land is allocated for road building or infrastructures, representing 267 hectares. The building of 20000 houses annually would necessitate a supplementary 670 hectares of urban land every year.

[2] This analysis was largely inspired by the writings of Professor Albert Ley / PhD in law, former Head of the land estate service, the land registry and land conservation in Cote d'Ivoire in *"le regie doanial et foncier et le developpement économique de la Cote d'Ivoire"/tome 18/1972*

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Peri-urban Agriculture Development in China

Jianming Cai

As a country with a very large population and a relatively small amount of arable land, agriculture has always occupied a very important position in China's economy. Throughout history, the food supply in China has been very fragile.

In order to promote mutual support of industry and agriculture, and at the same time the integration of the urban and rural economies, China reorganised its spatial arrangement in the 1960s by enlarging the administrative boundaries of most of its cities. For example, the total administrative area of Beijing was enlarged from 4,822 km^2 in 1956 to 16,808 km^2 in 1958, which included ten urban and periurban districts as well as eight counties. In 1949, the total area of the city was just about 63 km^2, including only four traditional urban districts.

This spatial enlargement of cities sparked the development of periurban agriculture in China. Thus, "suburban agriculture" (a term often used by Chinese scholars), is located mainly in the periurban areas and is fully oriented towards urban demand: the production of vegetables, fruit, milk, fish, livestock and poultry, as well as some high value-added grain products such as bean varieties. Suburban agriculture is labour-, and relatively capital-intensive with a high level of productivity. It has absorbed many rural labourers and provided a stable and diversified food supply to the urban residents in terms of quantity. More than 70 percent of non-staple food in the city, mainly consisting of vegetables and milk, was produced by the city itself during the 1960s and 1970s, with periurban agriculture playing a big role.

Cai Gaojian

Agricultural workers are preparing the organic fertiliser

Many new cities were born and many existing cities, particularly the big cities, grew further, both in population and in area. Subsequently, more rural people migrated to the cities in search of a better life.

This process promoted the further development of periurban agriculture, due to: 1) urban growth creating a larger demand for diversified agricultural products; 2) rural migrants replacing the cheaper labour force in periurban agriculture as many of these farmers started to work in the industrial economy; and 3) competition for the scarce land between different economic activities making periurban agricultural production more capital-intensive.

These changes (migration, farmers decision making, etc.) up to the 1980s and the end of food shortages provided a powerful engine for urbanisation in China in the 1990s. Around 1990, the food shortage in China, in terms of quantity, came to an end. However, problems in terms of quality remained.

The late 1990s marked a turning point that brought a new development in periurban agriculture in China. Instead of paying attention to the *quantity* of food supply, people started to give priority to the *quality* of food supply. China began to incorporate the concept of food security into its planning agenda and regarded it as a new strategy. Food security in China means a sufficient, sustainable, accessible, diversified and nourishing supply. And periurban agriculture is important for food security in China.

Different municipal governments carried out programmes aimed at modernisation of the peri-urban agriculture sector. Agro-tourism has become the most dynamic component of periurban agriculture in China in the last five years, thanks to China's rapid economic development. In fact, agro-tourism has become more important than agriculture itself in terms of employment and income generation in some parks in Beijing (3).

In Beijing, as well as in Shanghai, agriculture-oriented science and technology development and demonstration parks have been established. Xiaotangshan modern agricultural demonstration park in Beijing is one such park.

Xiaotangshan town is gaining fame for its agro-tourism. In 1998, the municipal government of Beijing decided to develop a large modern periurban agriculture demonstration park around the city. According to the master plan, the park will include four towns as well as 45 villages, covering an area of 112 km^2 with a population of more than 40,000.

Starting in 1998, a series of infrastructure projects were put into place. By 2001, the initial phase of the construction was completed and the park was opened to the public. In order to provide better service to the urban market, the park was further divided into eight sub-zones, each having its own focus. The eight sub-zones are classified as follows:

Cai Gaojian

Israel tomato, small in size but high in juice density

Precision agriculture zone: In this demonstration zone, all production processes such as irrigation, fertilisation, etc. are monitored and managed by a nerve centre equipped with (GPS, GIS and Remote Sensing) technologies, where it is demonstrated that yields per ha may increase by 18-30 percent at a lower cost.

Flower producing zone: Many popular and high value flowers, such as the lily, rose and chrysanthemum, are planted according to market demand in this zone. Currently, the producing capacity of the zone is 6 million plants.

Tree nursery zone: This area of 156 ha is one of the largest tree nurseries in China and in Asia; the zone can provide 2 million young trees each year to the urban market of a variety of species.

Aquaculture zone: Technologically supported by the National Engineering Centre for Freshwater Fishery, this zone is famous for its development of new aquatic products with green feed. Sturgeon is currently the main product.

Lamb raising zone: In this zone of about 67 ha, 30 million RMB Yuan (equivalent to approximately 3.6 million US Dollars) has been invested in infrastructure to raise 800,000 lambs per year. As an important component for local economic restructuring, all lines of service, from lamb breeding to mutton processing, are offered within this zone.

Seed zone: To speed up the economic restructuring of the surrounding rural areas and to enhance the value of their agricultural products, the seed zone has been designed to provide rural farmers with high quality seeds of selected flowers and crops. Currently, orchids and strawberries are the dominant specialisations.

Agricultural product-processing zone: Guided by urban market demand, agricultural products are carefully processed in this zone, and sent to various supermarkets in wholesale packaging. These products are usually displayed on special counters with a higher price than the regular products in the supermarkets.

Agro-tourism zone and programme: Located around the historical royal resort and the beautiful hot springs, various zones are included in the agro-tourism programme. It also offers hotels and venues for meetings, training and leisure activities.

The modern agriculture park in Xiaotangshan region is proving to be very successful. In the past three years, it has attracted 51 enterprises to operate their businesses in the various zones, with a total investment of 3 billion RMB Yuan. Up to 100,000 people have visited the park. It is expected that in the coming five years, more than 500 million RMB Yuan will be further invested in the infrastructure. In 2008, when the Olympic Games take place in Beijing, the park will be one of the most important green food production areas in Beijing and in China.

The following elements have attributed to the success of the park. Firstly, the strong push and promotion from all levels of government was a precondition and necessity, particularly in the initial stage when kick-off investment and preferential policies were needed. Secondly, the active involvement of enterprises has determined the success of the park and its zones. As key players, enterprises act as a platform between suppliers and consumers, providing services to both villagers and urban residents. With the advantage of comprehensive and intensive utilisation of the land resources, and effective quality control in its production systems, the economic return of modern periurban agriculture can be 30-50 times higher than before. Thirdly, the participation and support of local farmers has been a basic requirement for smooth development. The local farmers not only provide labour but also the permission for land leasing as they collectively own the land.

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Land as an Entry Point for the Development of Urban Agriculture: The case of Governador Valadares in Brazil

Marielle Dubbeling[1]

Governador Valadares has a population of around 250,000 inhabitants and is located along the river Doce, in the State of Minas Gerais in Brazil. A major problem of the city is the rising unemployment due to migration. However, the Municipality accounts for large areas of public and private vacant land, rivers and lakes with a distinct production potential for urban agriculture and fish farming. Moreover, the Municipality currently imports 90 percent of the vegetables consumed in the city. Taking these facts into account, the local government, in close collaboration with other actors, decided to promote urban agriculture, especially home- and community gardens and fish farms.

Ivana Cristina Lovo

Community garden Sao Paulo

In 2002, the city embarked on a multi-stakeholder process that aimed to integrate urban agriculture into municipal planning policies and programmes, as a means of increasing the access of the urban poor to land for food production. The long term goals were to eradicate poverty and strengthen participatory governance at municipal level. This initiative in Governador Valadares, and similar processes in Cienfuegos, Cuba and Rosario, Argentina (see Chapter 2) were supported under the project "*Optimisation of Use of Vacant Land for Urban Agriculture*" promoted by the Urban Management Program for Latin America and the Caribbean (UMP- LAC/UNHABITAT), the International Development Research Center (IDRC) of Canada and IPES – Promotion of Sustainable Development in Peru.

A multi-disciplinary team was formed by representatives of municipal departments (agriculture, planning and environment), social movements, NGOs and the University of Valadares. This team created the Forum for Urban Agriculture and Food Security, which took responsibility for documenting and analysing existing urban agriculture practices in the municipality, identifying problems and opportunities and developing a municipal action plan for urban agriculture.

The Forum decided to compile a land inventory to determine the sites in the city that would be suitable for (promoting or expanding) urban agriculture. A general lack of data on actual and potential use of land for urban agriculture implied that there were few guiding principles to determine targets for effective urban agriculture activities, or to capitalise on emerging opportunities. The land inventory therefore would help address these issues and in addition:

- improve availability of information on potential sites for urban agriculture in order to enhance planning and promotion of urban agriculture;
- provide a record on actual and potential agricultural land uses which could act as a benchmark for monitoring land allocation and land use change;
- identify links between urban agriculture and complementary urban management activities such as management of green areas, establishment of new housing schemes etc.;
- enhance the information base in general, to assist land use decision-making including neighbourhood plans and updating of by-laws.

Participatory baseline studies and land use mapping

Participatory baseline studies were carried out to identify and characterise cultivated and cultivable land in the city (in terms of property status, surface area, agronomic quality, feasibility of production and levels of accessibility). A typology of vacant spaces was developed by the project team, which distinguished:

- non-constructed municipal or state-owned land areas earmarked for future industrial or housing development, but could temporarily be used for urban agriculture;
- protected land areas or green spaces - mainly municipal tenure (urban parks, planted roadsides, public squares, green areas, river margins, and flood zones);
- public or private institutional land (belonging to commercial enterprises and social institutions such as schools, churches or hospitals);
- vacant or underutilised private household plots;
- urban water bodies.

Land use maps were based on information from urban producers and community representatives, and municipal databases (the land registry) and geographical information systems (GIS). In Governador Valadares, the use of questionnaires, plot diagrams and designs, and statistical analysis made it possible to get an understanding of the access and land use strategies of the poor producers.

Availability versus access to land

The study showed that the insecure tenure of, and access to, land by urban producers was a key limiting factor for urban agriculture development in Valadares. Availability of land was not the constraining factor (36 percent of the municipal land was deemed suitable for Urban Agriculture). Land already used for urban agriculture production was almost all privately owned (household plots). This indicated a problem related to individual or communal access to non-household plots (for example green spaces, river margins, and institutional land areas).

Ivana Cristina Lovo

Discussion groups durings meeting of the Municipal Forum

The Forum organised a municipal meeting, with the participation of more than 100 community representatives and different municipal departments, to formulate action proposals to overcome the identified obstacles to land access. They also discussed the prospective use in urban agriculture for each land type, identifying the best use for each area (such as fish farming, growing of medicinal plants, fruit or vegetable growing) in the future.

Inclusion in Municipal Planning

Urban agriculture was included in the revised City Strategic Development Plan, and thus recognised as a legitimate use of urban land. At the same time it was also included in sectoral programmes dealing with the management of green areas, urban water bodies (urban rivers and lakes) and low-income housing programmes. Incorporating urban agriculture land use in official GIS databases and the land registry also facilitated identification and formal leasing of vacant plots to poor producers.

Facilitating legal framework

A law that led to the reduction of urban real estate taxes for vacant lots that are allotted to urban agriculture production was enacted. The government undertook to intervene between institutional and private land owners on the one hand and urban producers and community groups on the other. The government could in this way facilitate (and control) temporary user rights to interested urban farmers.

Pilot Projects

From 2002 to 2005, 47 community gardens were initiated developed and were all located on institutional land areas and public green areas. These gardens receive municipal support in the form of infrastructure and technical assistance. A Community Gardeners' Association was formed and a weekly market for urban agricultural produce was inaugurated, with support from the Food Supply programme of the Municipal Department for Environment, Agriculture and Food Supply. A total of 1,500 families are currently involved in urban agriculture in Valdares.

Note

[1] Based on project documents of the Municipality of Governador Valadares and University Vale do Rio Doce.

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Resources

The Peri-Urban Interface: a tale of two cities
Brook, Robert M.; Dávila, Julio (eds) 2000 School of Agricultural and Forest Sciences, University of Wales, Bangor, UK; Development Planning Unit, University College London; UK London: DFID.
This publication is based on the research conducted by the Natural Resource Systems Programme of the UK Department for International Development on natural resources in the 'periurban interface'. It describes research conducted in two city-regions: Kumasi, Ghana, and Hubli-Dharwad, India.

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MDP. 2001. Report of a preparatory workshop. MDP. Harare, February 2001.
This report contains case studies commissioned by the Municipal Development Programme for a preparatory workshop in Harare, in February 2001The five country case studies are on Uganda, Kenya, Tanzania, Zambia and Zimbabwe.

Planning for Urban Agriculture: a review of tools and strategies for urban planners
Quon, Soonya. 1999. Cities feeding people series report no. 28. International Development Research Centre (IDRC), Canada.
On the basis of published and "grey" literature and a survey among 26 urban planning professionals from 18 cities around the world, key planning-related constraints facing urban farmers were identified together with possible responses to these constraints. The findings are compiled in this publication.

Placing the food system on the urban agenda: the role of municipal institutions in food systems planning
Pothukuchi, Kameshwari; Kaufman, Jerome L. 1999. In: Agriculture and Human Values No. 16 (1999) p. 213-224.
This article looks at the relationship of city planning and the urban food system in the USA. Existing and potential city institutions that could offer more comprehensive management of the urban food system are examined. These include the city department of food, the policy council, and the city-planning department.

The Peri-Urban Interface, Approaches to Sustainable Natural and Human Resource Use
Mcgregor Duncan et al (ed.). 2005. Earthscan, Paperback: ISBN 1-84407-188-X, Hardback: ISBN 1-84407-187-1
Periurban interfaces – the places where urban and rural areas meet – suffer from large problems caused by rapid urbanisation. This book gives a comprehensive overview of periurban (rural–urban) areas of the developing world, with extensive case material from Africa, Asia, Latin America and the Caribbean. And it lays out strategies for research and overcoming these problems and promoting truly sustainable natural and human resource development.

Continuous Productive Urban Landscapes: Designing Urban Agriculture for Sustainable Cities
Viljoen, A. (ed), 2004. Architecture Research Unit, University of North London, U.K. ISBN 0750655437, Paperback, 240 Pages. Price: £ 29.99
This book provides a design proposal for a new kind of sustainable urban landscape: urban agriculture. By growing food within an urban, rather than an exclusively rural environment, urban agriculture would reduce the need for industrialised production, packaging and transportation of foodstuffs to the city-dwelling consumers. The impact that this would have on the future shape of cities could be immense. Urban design is shown in practice through international case studies and the arguments presented are supported by quantified economic, environmental and social justifications.

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Environment and Urbanization Vol. 15, no. 1: Rural-Urban Transformations
Environment and Urbanization Vol. 17, no. 2: Chronic Poverty

www.iied.org
The International Institute for Environment and Development *provides expertise in achieving sustainable development at local, national, and global levels. Many publications, amongst others* ***Environment and Urbanisation*****, can be found here.**

www.ucl.ac.uk/dpu/pui
This is the site of the peri-urban interface programme of the University College of London. Research findings of this programme, general publications and related events are regularly updated.

www.mcgill.ca/mchg/
The website features the Making the Edible Landscape **Project:** This three-year collaborative project aims to demonstrate the value of including urban agriculture as a permanent feature in city planning and housing design. Project activities are being undertaken in three cities: Colombo, Sri Lanka; Kampala, Uganda; and Rosario, Argentina.

http://vancouver.ca/commsvcs/socialplanning/initiatives/foodpolicy/index.htm
This website reports on the development of a just and sustainable food system for the City of Vancouver (see also case study in this Chapter). Integrating urban agriculture into urban land use planning and design is key to their food policy.

www.planning.org/2006conference/sessionproposal/foodsystembg.htm
Site of the American Planning Association (APA). On this page an overview is given on The discussion of food system planning within APA and the annual conference in 2006. Furthermore on this site research highlights, publications and knowledge exchange.

www.cyburbia.org/forums
This bulletin board on urban/town planning-related topics has a page on u**rban agriculture and community gardening in urban planning.**

Chapter 4

Financing and Investment for Urban Agriculture

Financial support can make a significant difference to poor urban families. Many of the increasing group of urban dwellers who live around the poverty line are (informal) micro-entrepreneurs, involved in a diversity of activities such as waste collection and recycling, trading, having a shop, transport and farming. These entrepreneurs require access to working capital, but most of them face limited access to credit and investment schemes. Important lesson can be drawn from rural micro-finance programmes. The challenge now is to further build on these experiences, including (partnerships with) the private banking sector and rural innovative micro-finance institutions. This chapter reviews lessons learnt from studies in the urban setting.

Financing and Investment for Urban Agriculture

Yves Cabannes

Introduction

In cities around the world, urban and periurban agriculture (UA) is assuming an increasingly important role in making cities more sustainable. By growing food in the city, the urban poor can reduce household food expenses and generate additional income, thereby enhancing food security and reducing poverty. UA can also help recycle urban wastes, create green space in cities, and maintain existing green spaces in both urban and periurban areas (see further Chapter 1).

However, UA requires increased financial and political legitimacy if it is to continue developing as a productive force. While political support for urban agriculture has been steadily increasing, financial support for urban growers has been more limited. Most urban producers lack access to credit and investment schemes. Information about such schemes is also scarce. Evidence about the benefits of urban agriculture is anecdotal and deals mainly with highly localised, small-scale experiences. Little is known about credit and investment interventions around the world that could benefit large numbers of producers and thereby make UA a major contributor to productive and inclusive urban economies.

Azage Tegegne

A milk separator in Debre Zeit town, Ethiopia, finances by the Dairy Association

Thus, a more systematic survey and evaluation of significant and diverse modalities of finance and investment provision to urban agriculture were deemed very timely. This, more so, because the growth of the UA sector at the margin of the mainstream economy could not only aggravate the environmental and public health risks posed by bad practices, but could also undermine the ability of the sector to make an even greater contribution to food security, employment and income generation as well as productive management of idle or underutilised urban resources (land, waste and water).

This chapter thus examines how different types of urban and periurban agriculture (UA) are financed drawing on the following empirical, field, and scientific sources:

1. Analysis of 13 experiences with urban and periurban agriculture in Asia, Latin America, and Europe (see also Box 4.1);
2. Direct exposure to a large number of local processes in Latin America and the Caribbean region from 1994-2004;
3. Research and development of UA activities in the Fortaleza metropolitan region of Brazil (1988-1997) with special attention to the economic and financial dimensions of these activities (See Cabannes, 1997);
4. Publications by RUAF and IDRC-Cities Feeding People Program;
5. Observations following presentations on UA made at the World Urban Forum (WUF) networking seminar in Barcelona in 2004 (see also Box 4.2).

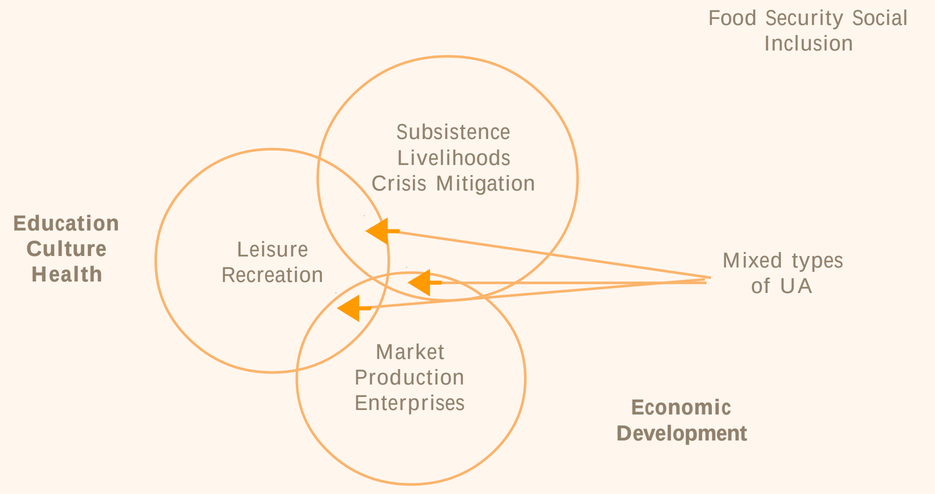
As a result, this paper reflects the collective work and contributions of a wide array of actors, both academics and practitioners. The central question of this chapter is "*what kind of financing is best suited to each different type of UA?*".

Types of Urban Agriculture

An analysis of current practices suggests that, to start with, some conceptual clarification is necessary to understand the different types of UA, in light of substantial differences (a) between subsistence-oriented activities and market-oriented activities, and (b) between these activities and urban agricultural activities as a source of leisure and recreation.

The choice of the most appropriate financing mechanisms for UA should be guided by **the type of UA system.** Currently, UA is being practised for meeting subsistence needs, as a market-oriented activity, for recreation, or as a combination of these, each of which requires a different financing instrument or mechanism. For instance, micro-credit may not be the best form of financing for a poor family that undertakes UA at subsistence level and is not capable of repaying a formal loan. And a small cooperative composed of farmers aiming for expansion of their UA activities would need forms of financial support that go beyond the provision of free access to seeds or other equipment. Thus it is necessary to getter an in-depth conceptual understanding of these types of UA in order to select the appropriate financing mechanisms of these interventions (See also figure 4.1).

Figure 4.1 *Various types of urban agriculture*



Cabannes, Y 2004a.

The first type of UA, and probably the most common, refers to UA as a way by which the urban poor and, to a lesser extent the middle class, support their livelihoods. In this case, UA plays a part in a *subsistence economy*, generally family-based, and is seldom monetorised. This activity does not generate a cash surplus but provides food or medicinal plants that reduce the expenses of the family, improves their diet and provides them with medicine (Cabannes, 1997).

The second type is related to *market-oriented activities*. They can be individual or family- based micro-enterprises or activities undertaken through larger cooperatives or producer associations. They refer to the whole food chain, from the production of vegetables, milk, fruit, and other products to agro-processing and marketing. As part of these *market-oriented activities*, the products are sold by directly by the producers at markets or through intermediaries. To a lesser extent, these products are dispersed of through formal distribution channels such as supermarkets and green grocers.

The third type refers to urban agriculture that is undertaken as a part of *leisure and recreational activities*, occasionally or regularly. This type is more common in the developed rather than the developing countries. In some cities, this type of UA is seen as a way to maintain or restore the relationship between urban citizens and nature, raise awareness on environmental issues and allow children to experience food production cycles.

Gabriel Ramírez García

The Flower Growers Association in the community of San Miquel Tlaixpan, Mexico.

Mixed forms are a *combination of two or three of the previously described types*. For instance, a family involved in UA for its own food consumption can also sell the surplus locally, providing extra, occasional cash. Similarly, European farmers practicing UA primarily as a recreational or health-related activity use some of the produce for food, thus reducing their home expenses occasionally.

Urban Agriculture and Municipal Policies

Beyond clarifying the types of UA, it is also necessary to improve our understanding of the links between these and other policy target areas, such as the alleviation of poverty, economic development, or environmental policies, so as to justify the financing of UA and mainstream it into existing policies and public support programmes. According to specific situations, municipal and national policies that aim at supporting UA can be part of a wide range of policies.

Urban agriculture can be part of *a poverty alleviation policy* that sees in UA a means to mitigate the effects of poverty and enable social inclusion. The main aim here is to ensure a ***food secure and inclusive*** city. Such policies can take special importance during a crisis, and support to UA can then be part of a crisis mitigation strategy. This is illustrated clearly by the Cuban national and municipal policies, which promote UA in the face of the crisis generated by the economic embargo imposed by the United States. It is also illustrated by the municipal policy of the city of Rosario, Argentina. The optimisation of vacant land and its transformation into cultivable land was a strategy to cope with the dramatic effects of the economic collapse of the country in December 2000 and the social turmoil that resulted from an increase of poverty to levels never seen before (Dubbeling, 2004).

Urban agricultural policies can also be part of a *local economic development policy* that focuses on income generation and job creation, for a whole range of producers, not only home-based or community-based and not necessarily poor. In this case, the rationale for urban agriculture is its economic value and its capacity to generate local economic development. The main aim is to achieve a ***productive*** city, one in which produce brought from outside the city is substituted with locally-grown produce.

Urban agriculture is in some cases part of an *integrated environmental policy*, with its main benefit being the greening of the city and raising citizen's awareness of nature. Increasing the access of the poor to a healthy environment or reducing the ecological urban footprint could be dimensions here.

In short, UA activities are, according to its different contexts, part of municipal policies for different reasons, considering their contribution to making the city more inclusive, more productive or more ecological. And this in turn allows urban agriculture to be linked to a broader sustainable development perspective that is based on similar elements, i.e. social, economic and ecological sustainability.

Learning from Field Experiences

Before examining the different ways to finance specific types of UA (be it subsistence, market-oriented, or recreation) as part of strategies that support poverty alleviation, local economic development or environmental management, some general findings and lessons learned from local practices and global research are presented here. More specifically, they include findings of a cross-sectional analysis of 13 innovative experiences of credit and investment schemes for UA, geographically representing various regions: Latin America (3), Africa (4), Asia (3) and Europe (3) (see also Box 4.1)

Box 4.1 *City survey of experiences related to credit and investment for urban agriculture*

The city survey and evaluation of significant and diverse modalities of credit and investment provision to urban agriculture were commissioned in 2002 and 2003 by UN-HABITAT, the Urban Management programme-Regional coordination for Latin America and the Caribbean (UMP-LAC), IPES-Promotion for Sustainable Development, International Development Research Centre (IDRC) and the International Network of Resource Centres on Urban Agriculture and Food Security (RUAF). The 13 cases commissioned were: (1) Micro credit and investment for UA - the municipal experience of Texcoco, Mexico; (2) Verticalisation program of UA - PROVE Pantanal, in the State of Mato Grosso do Sul, Brazil; (3) Social agro-breeding programme - PSA- in the municipalities of Cordoba and Camilo Aldao, Argentine; (4) WACS - Wadramli Agricultural Cooperative Society in Khartoum, Sudan; (5) Urban and periurban saving and loans cooperatives in Nepal; (6) Investment in the urban agriculture component of urban poverty reduction: the case of Miralao, the Philippines; (7) Micro-credit for UA activities in Bulgaria, (8) St. Petersburg urban gardening and farming: micro-credit and investment for UA in Russia; (9) Resources and financing of UA interventions in London: the Woodlands Farm and Vauxhall City farm experience; (10) The Horticultural Produce Cooperative Marketing Society: a success story of urban agricultural marketing in Bangalore; (11) Kintyre Lake County Development and Musikavambu Cooperative, Zimbabwe; (12) Investment and micro-credit for UA in Gaborone, Botswana; (13) Credit and investment of large companies and credit to small producers in Nairobi, Kenya. (See also figure 4.2.)

Summarised descriptions of these cases are available in the ninth issue of the Urban Agriculture Magazine (RUAF, April 2003). A synthesis paper and a policy brief on micro-credit for UA were elaborated by IPES and UMP-LAC in cooperation with the Centre for the Promotion of and Employment in the Urban Informal Sector (CEPESIU -Ecuador), systematising the case studies and discussing options, lessons learned, and proposals for an agenda for more effective support and promotion. Some of the involved municipalities are currently testing new financing instruments for UA, and are requesting further support.

Reality of finance for UA

A crucial finding of the research, substantiated by cases studied, is that micro-finance institutions, banks, and micro-credit initiatives seldom allocate resources and loans to urban and periurban activities. Financial support to (peri)urban producers and agro-industries seems to be taken on as part of rural agricultural support programmes, as is the case in Gaborone, Texcoco, Camilo Aldao and Addis Ababa, or as part of urban community development programmes (Philippines). Credit is the exception rather than the rule. In addition, credit for urban agriculture and urban-agro processing is rarely incorporated in banking statistics or public budgets. These, and other factors, make it difficult to determine if loans have been allocated to urban, periurban or rural based activities. These methodological and technical difficulties tend to further blur the reality of finance for UA, as limited as it is already, and is an issue that deserves future attention.

Figure 4.2 *Location of case studies*

Source: Survey of city experiences with credit and investment for Urban Agriculture interventions, IPES / UMP-LAC / IDRC.

Three basic ingredients of UA financing: savings, subsidies and credit

The cases describe a variety of financial systems and mechanisms for (peri)urban agricultural production and marketing. Urban and periurban agriculture is usually financed through a highly variable combination of savings, subsidies and credit (primarily micro-credits).

Key role of savings and resource mobilisation

Urban farmers rely heavily and primarily on the mobilisation of their own funds. By and large, urban agriculture for subsistence is self-financed. Generally speaking, resource mobilisation and savings occur in very different ways and can be: a) individual b) family-based c) collective savings of small groups of producers or d) community-based. There are situations in which voluntary and organised savings are more formalised as in the case of the Nepalese savings and credit union cooperatives.

The variety and sources of subsidies

A second type described here is subsidies or donations for agriculture in the city, again in different forms:

a. financial subsidies to the banking system, such as those related to “soft conditions” for credit,
b. subsidies directly to the farmer, for main agricultural inputs (land, water, seeds etc), or subsidies in the form of free technical assistance and training or support to obtain inputs (Botswana, Nairobi-Kenya), and

c. subsidies to generate a facilitating environment such as in St. Petersburg, where a positive environment for agricultural production in and around the city is created by subsidising transport to agricultural plots and markets.

Private sector subsidies such as grants and charities from NGOs and other civil society groups (as is the case in London), and from public subsidies coming from local and national government such as the case of the HOPCOMS cooperative in Bangalore are other forms of subsidies.

Another key lesson from the research is that fully commercial loans, eg. those operating at a full cost recovery approach, are an exception and not the rule. This underlines the need for subsidy policies.

Municipality of Camilo Aldao

Cooling plant, dairy farm project in the Tambo Community Project, Argentina

Credit systems

A third group is (micro-)credit systems. These encompass credit funds supported by international donors (Bulgaria), national governments (Argentina), federal or municipal governments (Brazil), private banks, informal private credit, or NGOs and cooperatives (Sudan). Most existing credit and investment schemes however are not accessible by the poor or other vulnerable groups, as clearly identified in the Bulgaria experience. Poor urban farmers usually cannot afford the requested collateral or the high interest rates, while they often lack access to marketing or management experience. There are however several innovative experiences that allow for the participation of these excluded groups. In Argentina, for example, participation is restricted to those who do not have additional forms of income or whose family income does not add up to more than two minimum salaries (US$156). In Nepal, the system of peer or group lending incorporates a system of solidarity guarantees which excludes physical collateral is required. In Texcoco (Mexico), grace periods are defined in relation to the type of production system and cycle (including for example longer grace periods for animal husbandry systems). All cases point to the need of integrated development strategies, where financial support is complemented with training (technical and business skills), legal advice and marketing support.

Combination of strategies

Most studies indicate that financial support for urban agriculture is best based on a combination of all three mechanisms: savings, subsidies and (micro-)credit. Savings could for example work as collateral for receiving credit. Tax incentives or other subsidies could motivate people to become involved, and complement credit systems with training and assistance, and in this way better guarantee success and sustainability of the (integrated) support programmes.

Understanding the financing credit cycle: from financial sources to financial products

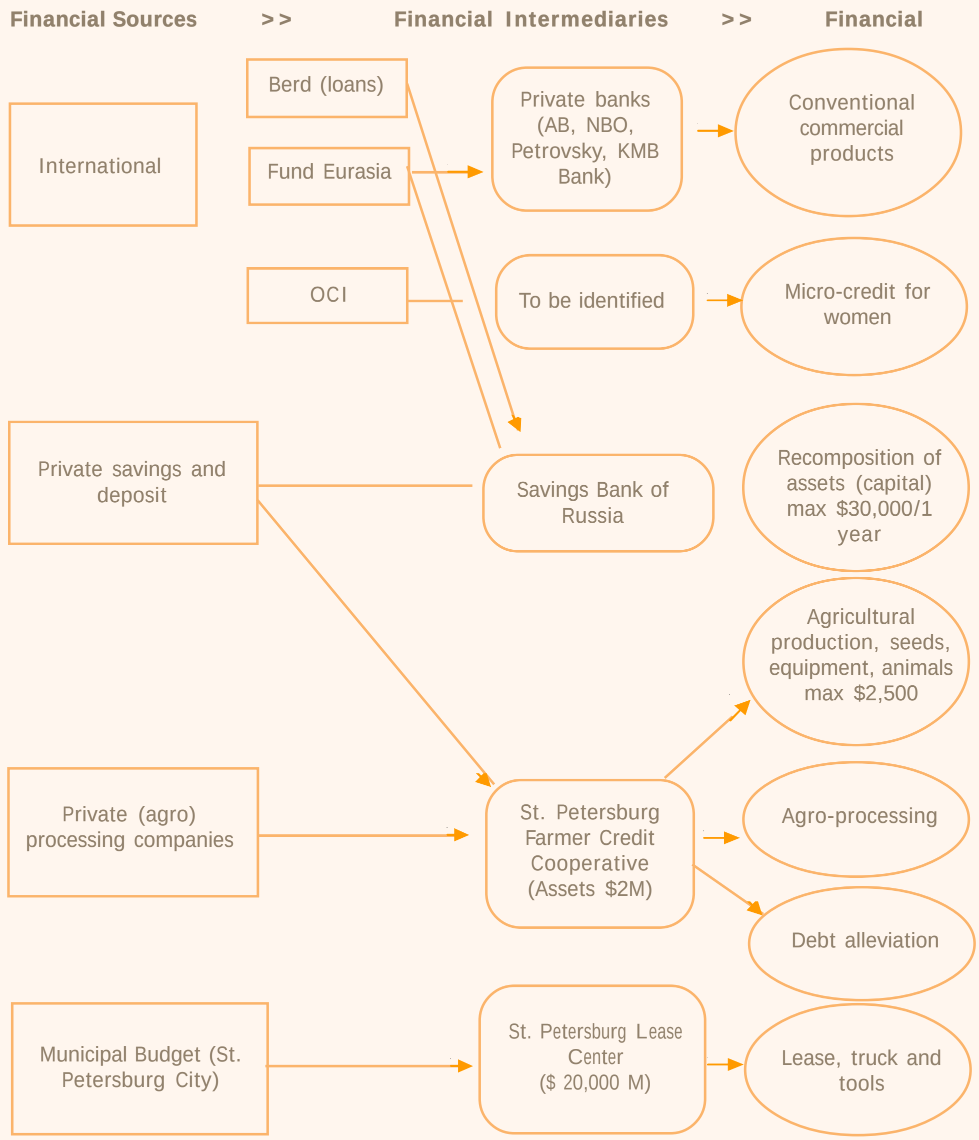
In general terms the financing cycle can be summarised in three successive steps. The first refers to the sources of finance, which can be international, national or local, from public, private or institutional sectors or from private savings. The second refers to the transformation of these resources into financial products by specific financial intermediaries, and the third to the type of products financed.

The St. Petersburg UA financing cycle: an example of complexity

Financial flows and products for urban farmers from the study case of St. Petersburg, Russia, Moldakov 2002 (see figure 4.3) illustrate the complexity and the richness of financing UA.

The sources of finance are of different origin: (a) International, being loans and grants through the European Bank for Reconstruction and Development or the Eurasia Fund; (b) Private (agro) processing companies; (c) Private savings and deposits from individuals and (d) Public resources coming from the municipal budget. These sources have varied time-lines: the savings and deposits are on a monthly or occasional basis, the municipal budget is annual; the international resources are usually made on a project-by-project basis, stipulating a number of years for disbursement. Transforming such different resources into strong, reliable and steady credit (financial products) is a key issue in any financial system. The answer lies essentially in the quality and the nature of the financial intermediary that will transform these resources into financial products.

Figure 4.3 *Financial flows and financial products for urban farmers in St Petersburg, Russia*



Source: Moldakov, O. "Saint Petersburg Urban Gardening and Farming. Micro credit and investment for Urban Agriculture in Russia, St. Petersburg Urban Gardening Club," St. Petersburg, Russia 2002 Cabannes, Y 2004a.

The case of St. Petersburg is typical of the multiplicity and different characteristics of the financial intermediaries, some of them being local and others being a branch of a national bank. Some of these institutions have a unique source of financing whereas others have the capacity to draw on from multiple sources. The main institutions identified in this particular case are: (a) *St Petersburg Lease Centre*, having a limited volume of resources, drawn mainly from the municipal budget; (b) *St. Petersburg Farmer Credit Cooperation*, fed by both private agro-processing companies and private savings; (c) *Saving Bank of Russia* that is channelling international credit and grants to various Russian cities, including St. Petersburg; (d) some private banks, such as the *Petrovsky bank*, AB Bank or NBO Bank, who in their turn receive funds from national and international sources.

These multiple sources and the variety of financial intermediaries explain the wide variety of products that an urban farmer can access, in theory. They cover the following kind of credits and grants: leases for trucks and tools, debt alleviation; micro-credits for agro-processing or for agricultural production, seeds and animals; short term loans (less than one year) for composition of assets; micro-credits especially for women or conventional commercial loans, open to clients able to provide a high level of guarantee.

The Botswana experience

Figure 4.4 " Financing of UA in Botswana"[1] shows, as in St. Petersburg, the multiple intermediaries that transform very diverse financial resources from central government, individuals, international and private enterprises into loans and grants to urban farmers. In this case, the following intermediaries were identified: (a) commercial and parastatal banks; (b) Citizen's Entrepreneurial Development Agency - CEDA (c) Cooperatives; (d) African Development Foundation, (e) NGOs (f) Micro-Finance Institutions

The existence of multiple intermediaries does not always mean that they are resourceful and that their products are accessible to most urban farmers. They suggest on the contrary that some effort should be made in order to connect these initiatives and to focus on the one(s) that would have the best comparative advantages. The complexity of intermediaries, as illustrated by these two cases, was found in most situations analysed. This suggests that efforts should be taken to give this information to urban farmers in a simpler way. Urban farmers are usually interested in knowing about the reliability, quality of service and financial conditions on loans of intermediaries. But above all they are interested in clear information on the duration of credits and grants offered. Brochures that explain these options in simple terms appear to be a necessity, not only in St. Petersburg and Botswana but in the majority of the cases studied.

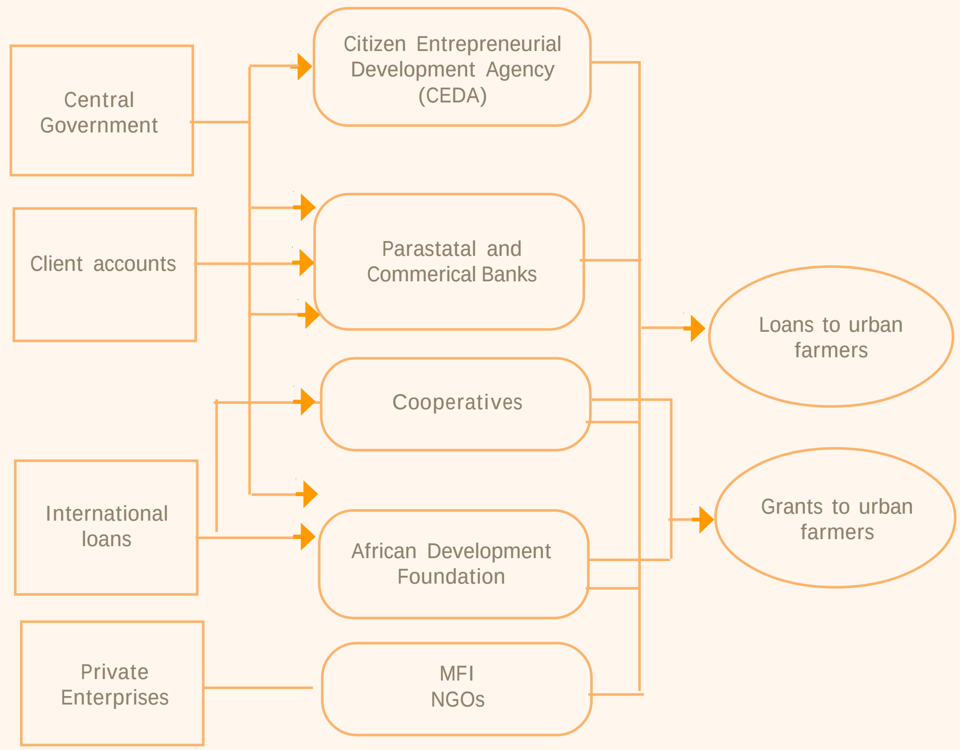
Role and Diversity of Financial Intermediaries

Analysing all the cases, it is clear that a large number of actors are involved in providing (sources) and managing funds (intermediaries) for (peri)-urban agriculture. A more detailed analysis is needed to define which system(s) is/are best adapted to the specific local circumstances. Funding sources are found in the context of poverty alleviation programmes, food security programmes (Argentina) employment generation programmes (Brazil, Botswana), or integrated environmental management programmes. Funds stem from for example the "Fund for Social Municipal Infrastructure" (Mexico), "Fund for Social Investment" (Brazil), within general "Financial Assistance or Entrepreneurial Programmes" (Botswana) or through specific "Agricultural or Horticultural Programmes" (as is done in India). However, in most of the studies, there is confusion and overlap between the source of funds - private, public, institutional, international - and their transformation into credit or subsidies. These two aspects and the role different actor's play in each of them should be distinguished and clarified.

A typology of intermediaries that transform resources into loans directed to urban farmers can be drawn up for this purpose (see Figure 4.5). Some typical situations include:

a. Public intermediaries at local level (see initiatives from two local governments, Texcoco in Mexico and Rosario in Argentina),
b. Private and community-based intermediary (illustrated by the experience of a saving and credit cooperative from Nepal) and
c. Private banking system with the case of Prove Pantanal (Brazil) or combinations of all the above (Botswana, St. Petersburg).

Figure 4.4 *Financing of urban agriculture in Botswana*



Source: Mosha, A.C. "Credit an Investment for Urban Agricultural Interventions: Case Study: Gaborone City, Botswana," University of Bostwana, Gaborone, July 2002 & Keboneilwe, D.L. "Credit and Investment schemes for urban agriculture". Power Point presented for the International Panel Microcredit and Investment for Urban Agriculture, Barcelona, 2004.
Cabannes, Y 2004a.

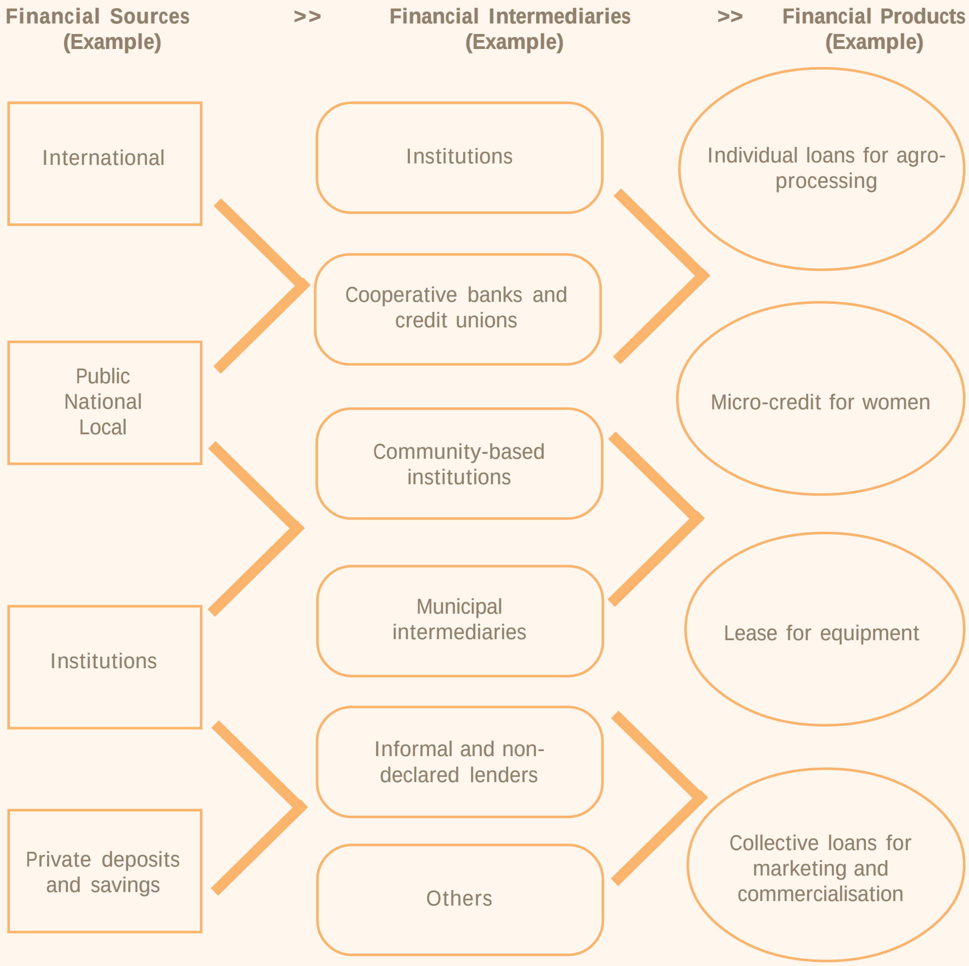
Municipal intermediaries

The experience of Texcoco, Mexico

The local government of Texcoco, in the Mexico metropolitan region, set up an innovative urban agricultural loans programme a few years past this date (see Figure 4.6), and obtained significant results (See Ramirez-Garcia, 2002) both in financial and social terms.

Resources from the central governments were transferred to local governments, as part of a vast national social programme. The Texcoco municipality decided to transform these resources into a limited and innovative set of loans to agricultural cooperatives (in particular for flower production) and to small solidarity groups of producers that had not yet formed cooperatives, as was the case with a group of rabbit keepers. A third line of loans was specifically tailored to women urban farmers. No specific institution was set up and the resources were simply earmarked and deposited in a bank that was managing the municipal resources.

Figure 4.5 *Financial intermediaries in the urban agriculture financial cycle*



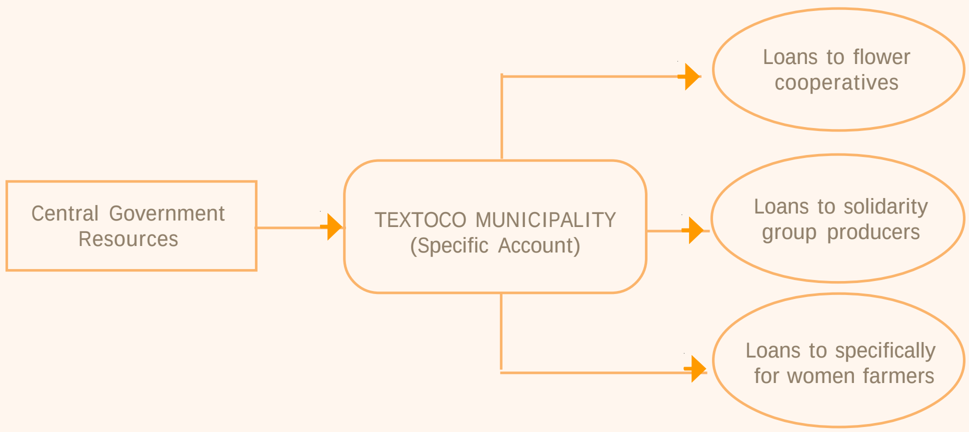
Cabannes, Y 2004a

After a couple of years, this successful programme received less attention from the newly elected local senior officials and the mayor. Despite requests from the producers, the technicians in charge and the university that was technically supporting the activities; the programme was left to die out slowly.

Participatory budgeting in Rosario, a promising initiative
The recent experience of the city of Rosario, a city of one million inhabitants in Argentina, shows under which conditions municipal earmarked resources can meet the needs and the expectations of urban producers, Municipalidad de Rosario (2003) (see also Figure 4.7).

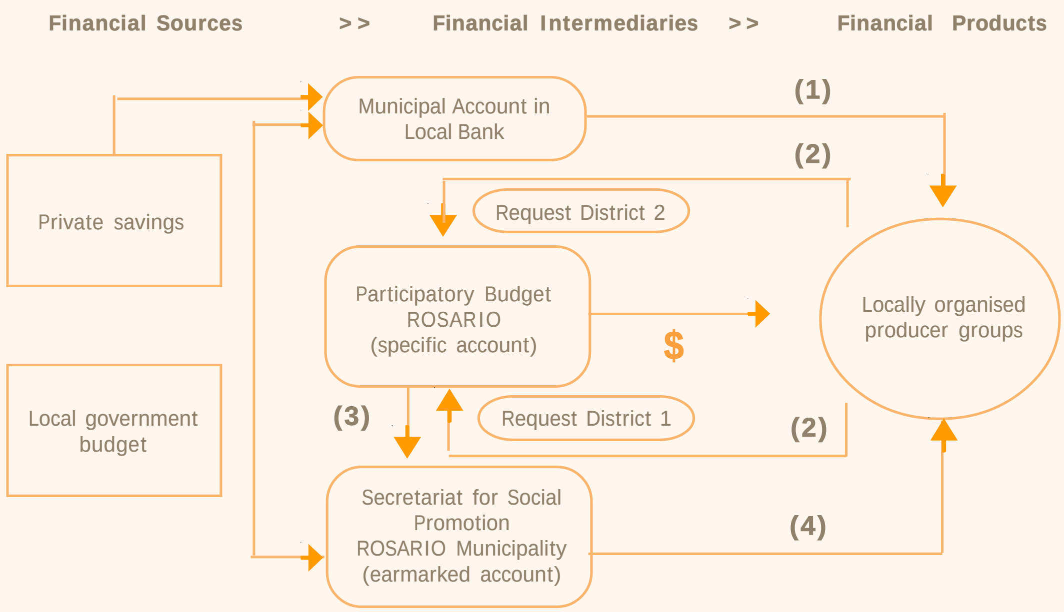
Here, the financial resources for UA are managed in two different ways: on the one hand, the Municipal Secretariat for Social Promotion develops a set of support activities to assist local urban farmers (input supply, technical assistance, and training). In addition, Rosario started a Participatory Budgeting Approach[2] in 2002 through which citizens – whether organised or not - could control how part of the public resources of their cities is used. Interestingly enough, in two out of the six districts of Rosario where the approach was introduced, organised urban farmers proposed projects related to the production and processing of UA vegetables and medicinal plants. These two projects were eventually prioritised and were integrated into the municipal budget allocations. The corresponding resources were then earmarked within the Municipal Secretariat for Social Promotion. Financially speaking, they were included in the budgetary allocation and specific funds were deposited in the bank managing the budget of the city.

Figure 4.6 *Financial flow for urban agriculture, Texcoco, Mexico*



Source: Ramirez-Garcia, G. "Estudios de Micro crédito e inversión para la Agricultura Urbana (AU): Caso Texcoco, Mexico," Centro Operacional de Vivienda y Poblamiento A.C., México, 2002.
Cabannes, Y 2004a.

Figure 4.7 *Financing of urban agriculture with participatory budgeting, Rosario, Argentina*



Source: Municipality of Rosario and field visit.
Cabannes, Y 2004a.

The key element that differentiates the experience in Texcoco from that of Rosario lies in the control of resources. In Rosario, the producers have direct control of public resources (bottom up approach), whereas in Texcoco, decision-making over the resources always remained in the hands of the local government. However, even though participatory budgeting allows for better adaptation of public resources to the needs of the population, it is not a full guarantee of continuity as the process could be interrupted by circumstances such as a change of government.

Public resources and subsidies have been a crucial source of funds for facilitating the access to credit of small urban farmers, and for leveraging and channelling additional resources. However, the dependence on public money has the risk of a sudden interruption to or closing of excellent and economically successful UA activities. The case of Texcoco shows the risk of depending on public resources as the UA programme was halted after a change of local government. The extent of independence of a financial intermediary and its ability to survive political or policy changes should be given close consideration. In order to reduce the dependency of a credit system on political will, it is necessary to build strong intermediary financial institutions that can lend and work with public money, but that will not depend on political orientation for their continuity. This is probably one of the key issues to be dealt with as far as financing of UA is concerned.

Here, the financial resources for UA are managed in two different ways: on the one hand, the Municipal Secretariat for Social Promotion develops a set of support activities to assist local urban farmers (input supply, technical assistance, and training). In addition, Rosario started a Participatory Budgeting Approach in 2002 through which citizens – whether organised or not - could control how part of the public resources of their cities is used. Interestingly enough, in two out of the six districts of Rosario where the approach was introduced, organised urban farmers proposed projects related to the production and processing of UA vegetables and medicinal plants. These two projects were eventually prioritised and were integrated into the municipal budget allocations. The corresponding resources were then earmarked within the Municipal Secretariat for Social Promotion. Financially speaking, they were included in the budgetary allocation and specific funds were deposited in the bank managing the budget of the city.

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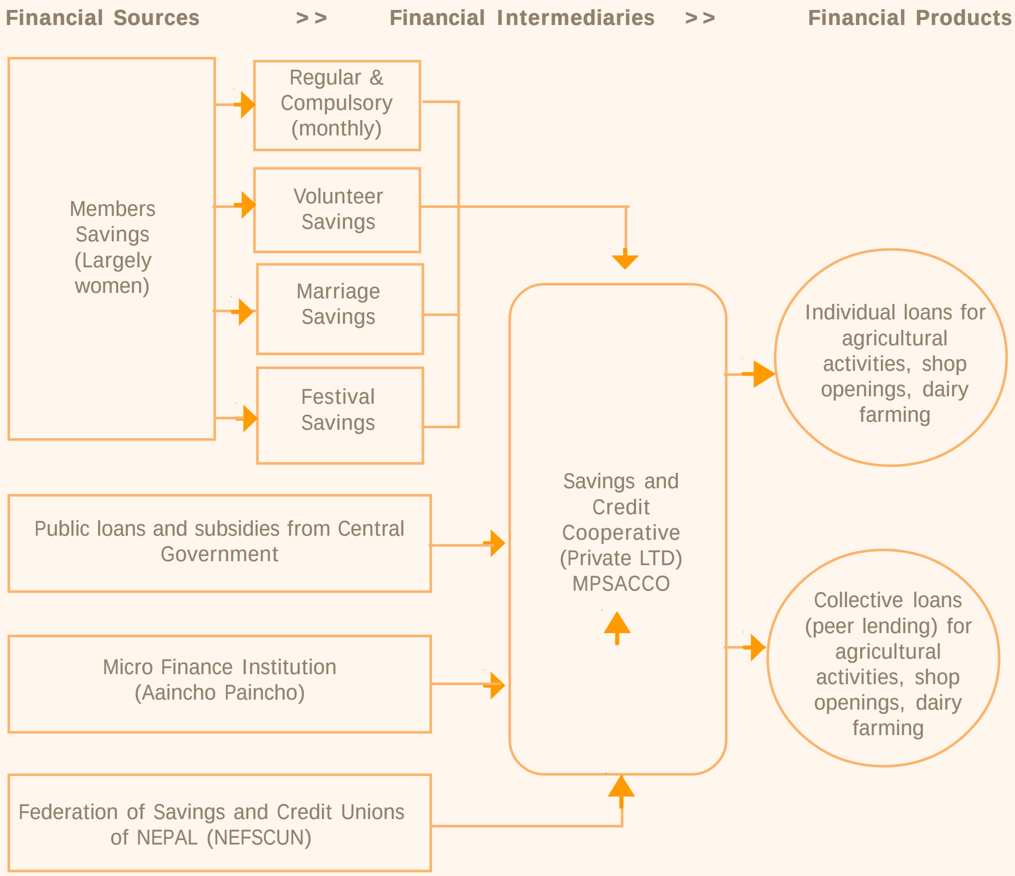
Private and community based intermediaries
The experience of a savings and credit co-operative in Nepal
The Mahila Prayas Savings and Credit Co-operative Ltd. (MPSACCO) was established in Nepal in 1998. This relatively young institution offers both individual and peer lending for agricultural activities, for setting up shops and for dairy farming[3]. (See also Figure 4.8)

Figure 4.8 *Financing of urban agriculture in Nepal*



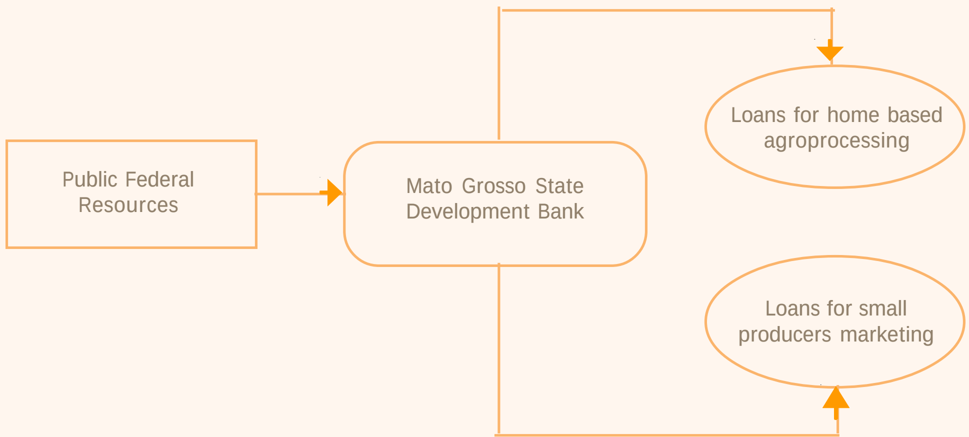
Source: Centre for Micro Finance (CMF) Nepal. "Managing Credit and Investment Schemes for Urban/Peri-Urban Agricultural Activities: A Case Study of Two Urban Based Cooperatives in Nepal," CMF: Kathmandu, Nepal, 2002.
Cabannes, Y 2004a.

The financial resources of the cooperative's members is generated through various types of savings such as regular compulsory (monthly), voluntary, marriage and festival savings. This variety indicates how a community-based banking facility is tailored to cultural and local practices and substantially different from conventional banking systems for the poor in which savings is simply a compulsory activity that is precondition for getting a loan.

In addition, the central government provides loans and (limited) grants. Various "Social Economy" institutions have provided loans, occasional subsidies and technical assistance to MPSACCO and its members (i.e.Cooperative Development Board, Federation of Savings and Credit Unions of Nepal and Aaincho Paaincho, a Micro-Finance Institution).

Private and banking sector as financial intermediaries
The Prove experience in the State of Mato Grosso do Sul, Brazil, is based on a similar successful experience carried out in Brasilia, in the mid 90's[4]. Its basic principle is to provide credits and technical assistance to home-based producers, so that they can add value to their agricultural family-based production by processing primary produce and selling it to supermarkets.

Figure 4.9 *The case of PROVE Pantanal, Mato Grosso do Sul State, Brazil*



Source: Araújo, P., Szukala, S. "Programa Prove Pantanal, Study Case of the IPES/UMP/IDRC Research Program, sd, 38 pp.
Cabannes, Y 2004a.

The credit that Prove provides at state level was funded through Central Government resources, while the technical assistance comes from the State Government budget. Interestingly, the State Government separated the technical assistance component from the management of the credits, and delegated the financial management to a development bank operating through its branches at State level. The bank authorises the various loans and the borrowers repay at this same bank, in a fairly conventional way.

Such a model raises again the issue of what might happen in the case that the Federal Government stops feeding the current credit line. Two answers might be given. For one, the loans are paid back to the State Development Bank that does not have to pay back to the Federal Government. The budget allocation from the Federal Government to the State Bank is used as a starter for generating a revolving fund. The money paid back by the clients can be given out again as loans. However currency devaluation and possible reimbursement defaults will cause the lending capacity to shrink.

Secondly, this financial set-up has had the opportunity to open the doors of the bank, in most cases for the first time ever, to family-based urban farmers. If they pay their first loans back and thus gain credibility, they will be in a better position to apply for future loans from the bank, beyond the specific, subsidised PROVE credit line. In this sense, the PROVE programme acts as a bridge between informal producers and the formal banking system, and this makes it especially attractive.

Producer involvement in management of resources
The financial intermediation, as far as the studies are concerned, is an area of great innovation that deserves more attention. A thorough understanding of the best adapted financial

intermediaries - either a private cooperative such as in Nepal; a public/private one in Bangalore; a public bank such as in Mato Grosso do Sul; or a private bank - is crucial in order to optimise the financial sources. In this context, involvement of producers/user groups in fund management such as is often the case in credit cooperatives, credit unions and community-based financial organisations appear as viable and important mechanisms that necessitate attention. The cases of London and St. Petersburg and the group credit mechanisms in Sofia are also particularly relevant.

Conclusions

How are the different types of urban agriculture currently financed?
Earlier in this chapter, three types of urban agriculture (UA) have been identified. Further, financing of urban agriculture has been discussed by means of a varying combination of three financial mechanisms: (a) mobilisation of both financial and non-financial resources by the urban farmers and their families, (b) subsidies, which may come from varying origins, especially public and international, and are usually channelled through differing mechanisms, and (c) credit provision, generally limited in amount, and usually for individual borrowers, and not so much for groups.

A matrix can be drawn to co-relate the origins of the resources to the differing types of urban agriculture. Such a matrix shows the most common situations and can help in deciding on the most desirable options for financing urban agriculture in future. Figure 4.10 depicts the most common situations in the cities studied.

Figure 4.10 *Financial sources according to the type of urban agriculture*

Origin of finance / Type of UA	Savings & Resource Mobilization	+	Credit & Loans	+	Subsidies	=	Total
Home consumption & livelihoods	$$$				$		$$$
Micro enterprises &productive commercial activities	$		$$		$		$$$$
Recreational activities & environmentaleducation	$				$$$		$$$$

Cabannes, Y 2004a.

Subsidies, both from public and international sources, can allow the financial burden on small urban producers to be reduced. Since subsistence agriculture is not commonly commercialised, and is undertaken by a large number of urban poor people (generally without land titles, fixed employment or a regular income) who are often unable to secure conventional banking guarantees, credit for this type of urban agriculture is almost non-inexistent. Unfortunately, they are the neediest and have the most to gain from financial assistance, but are precisely the ones who receive the least support.

The second type, the more commercial and economically-focused UA, appears to have limited access to credit. In addition, as shown in the experiences referenced in this study, it receives non-financial subsidies, such as technical assistance or other inputs in the form of seeds, equipment and tools.

The third type of urban agriculture, more recreational and educational nature or related to healthy practices in the cities, is probably the form of UA which is most subsidised, mainly by public resources (see examples from Europe, Canada or the experiences in St. Petersburg). Notwithstanding, it also depends to a large part on the capacity of the urban producers to mobilise their own resources to pay the rents for their plots or the taxes levied.

How to optimise the available financial resources and for which type of urban agriculture?

There is no one solution to this question. The matrix below (see figure 4.11) can help in deciding on the allocation of resources according to the type of urban agriculture practiced and to which kind of urban farmer financial support should be directed to.

Figure 4.11 *The necessity to adapt and optimise the resources according to the type of urban agriculture desired*

UA cycle Origin of finance	Savings & Own Resources	+	Credit & Loans	+	Subsidies	=	Total
Home consumption & livelihoods	?		?		?		?
Micro enterprises &productive commercial activities	?		?		?		?
Recreational activities & environmentaleducation	?		?		?		?

Cabannes, Y 2004a.

However, one can suggest that public resources from central, regional and local governments should be distributed more evenly between the different UA types than is being done currently. Some of these public resources should also be used to reduce the financial exclusion of poor families and urban farmers, especially those to whom urban agriculture is a vital source of food and medicines. Access to affordable credits and credit conditions is also crucial.

A similar analysis can be applied in trying to identify which UA activity should be financed: primary production, processing (agro-industries) or marketing (figure 4.12).

Figure 4.12 *Urban agriculture production cycle and sources of financing*

UA cycle Origin of finance	Cultivating and Breeding	>	Agro Processing	>	Marketing Commercialisation
Savings and own resources	$$		$$		$$
Credit and Loans	$$		$		$
Subsidies	$$$		$$		$

Cabannes, Y 2004a.

One can observe in the case studies that both subsidies and credit tend to concentrate in the first phase of the UA cycle, during the growing cycle of crops or for the raising of animals. There are very few experiences and financial systems in which resources have been concentrated in the agro-processing phase (i.e.preparation of frozen food, food preservation or making of extracts and natural essences for medical use) and in the marketing and commercialisation phase, particularly in the formal sector (supermarkets, permanent markets, hypermarkets).The experiences of PROVE in Brazil and Camilo Aldao in Argentina are extremely relevant, because they clearly demonstrate the positive results that are obtained when credit and subsidies are concentrated on the latter phases of the UA cycle.

In the light of several successful experiences, financial systems should support the demands of the urban producers and service their needs and initiatives. Participatory budgeting processes, which allow urban farmers to exercise their citizen's rights and decide on the destination of public resources, are encouraging and deserve much attention. Specifically, a gender equity focus in the definition of target groups and operational structures should be incorporated.

On the other hand, political legitimacy and support remains crucial to further development of UA. Under the current circumstances, specific support from municipal governments will be necessary for urban agriculture, especially when dealing with urban poor and vulnerable groups. Beyond facilitating access to finance, secure access to land and water sources are of paramount importance (see also Chapter 3 in this book).

Recommendations

One of the main conclusions of the present study is probably the significant lack of appropriate "financial products" for urban farmers and producers that could help them cultivate, process and better market their farming products. The shortage of credit, as well as limited access to credit, forces us to think about several strategies that are not mutually exclusive:

- Setting up of municipal funds for UA;
- Establishing a system of evolutionary loans (loans that develop over time) with decreasing subsidies; and
- Drawing on existing rural and urban housing and micro-enterprise credit systems.

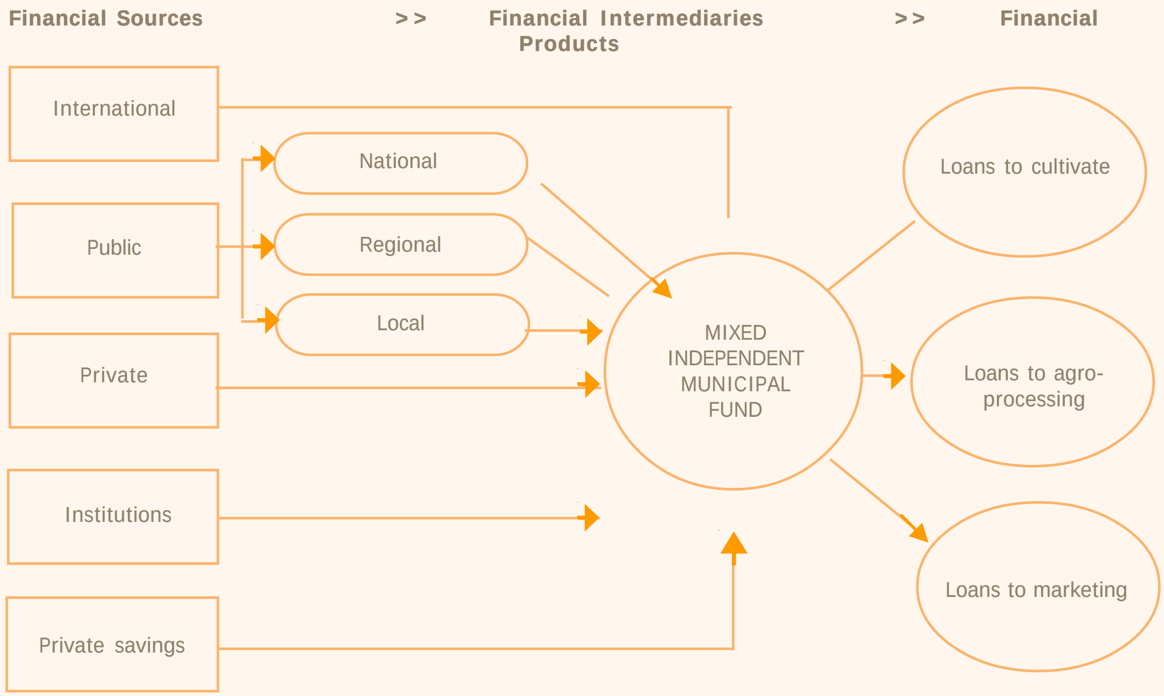
Municipal local fund for UA and for economic and social inclusion

Mixed municipal funds are not yet very common in the field of urban agriculture, but they exist in other sectors such as home improvement and / or generation of income. Figure 4.13 illustrates a central element of these funds, which is the diversity of their financial sources to include international donations or loans, public resources and private savings particularly of urban farmers.

Such devolution of power to the people was part of a broader approach on empowerment through credit. Such an approach was not incompatible with a financial rationale. As a matter of fact, the financial results were much better than in any of the formal banking systems. One the one hand the level of reimbursement was significantly higher and the proportion of defaulters was minimal. On the other hand, the administrative costs for the whole programme were extremely low, mainly because of the involvement of the community at each stage of the process.

The final aspect that needs emphasis is that these mixed funds should have a bank account in the most suitable financial institution operating at local level, be it a commercial bank, a cooperative bank or a development bank.

Figure 4.13 *Mixed municipal fund for urban agriculture*



Cabannes, Y 2004a.

Evolutionary loans with decreasing subsidies

The co-responsibility principle applied in such municipal funds, between the government (contributing with subsidies), the citizens (mobilising their savings and paying back their credit) and the private sector (who contributes generally with credit lines) also constitutes the basis for models of evolutionary loans with decreasing subsidies.

Other principles are that credits are limited in value (and thus more accessible), are of short duration, and are progressive, which means that the second credit can be superior to the first, and the third superior to the second. The above mentioned "Better Homes" programme, for example, grant loans with a duration of less than 12 months and less than US$ 300 dollars in value, which were equivalent in 1997 to three monthly minimum wages.

The numbers in the rows of the table (Figure 4.14) indicate the proportion of the savings, of the subsidy and of the credit to the total value of the loan. For instance, for the first loan, the value of the compulsory savings in 1997 was around US$ 100, whereas the subsidy was US$ 200, and the maximum amount of credit was US$ 300, adding up to total of $ 600. With this amount of money a family could improve part of its home, for instance adding a room, changing the roof tiles or building an outer wall around the family plot. For subsequent loans, the subsidy is gradually reduced, whereas the saving component increases, along with the value of the credit.

These evolutionary loans are progressive steps that lead people to get access to the formal banking system. In the model presented here, the initial idea was that the fourth loan was not granted by the municipal local fund, but alternatively by private banks. The fund thus acts as a bridge that allows poor people, normally excluded from the formal banking system, to get access to higher-valued loans managed by banks, having being gradually introduced to repayment obligations and systems of savings. The regressive subsidies, in addition to their value for the people, acquire a social function, fostering the inclusion of those who had no access to formal credit before. It would be interesting to carry out additional research to monitor and assess the level of actual "banking exclusion" of those involved in the Brazilian and other similar projects.

Figure 4.14 *Evolutionary loans with decreasing level of subsidy, the Casa Melhor model, Brazil*

	Savings	+	Subsidies	+	Credit	=	Total
1st loan	1		2		3		6
2nd loan	2		1		3		6
3rd loan	2		0		4		6
4th loan	Private banking system						

Cabannes, Y 2004a.

Drawing from existing banking initiatives and credit

Drawing from rural loans

The first strategy would consist of channelling credits for "rural agriculture" to periurban and urban agriculture. The knowledge accumulated over the years in rural financing should be applied to UA as well. The practical experience of organisations working in rural areas should also be tapped into. Examples of rural innovative micro-finance institutions are found in cooperatives with owner-membership and solidarity groups or credit groups (or rotating credit groups), which are less formal, and are donor-driven or traditional like those found in West Africa. These also include village banks, which can be seen as a combination of cooperatives and solidarity groups, and micro-banks, which are not based on membership but more on individual contracts. All these experiences are aimed at reaching the poor micro-entrepreneurs and at creating sustainable financial support systems. The achievements of the Wadramli Agricultural Cooperative Society, close to the city of Khartoum in Sudan, are a noteworthy example.

Loans for productive homes

Many urban agricultural activities are home-based, and therefore, the notion of "productive housing", i.e. a home that is not limited to a residential function, is a key feature of UA. Micro-credits or housing loans to upgrade or to develop the "productive side" of a house (adding on a small workshop, a kitchen that will become a small restaurant opened to the public, a room to process what was cultivated or transforming a vacant backyard into a place to cultivate plants) have been very difficult to include within conventional building loans, even for home improvement loans. Despite the success of the few experiences such as the "Casa Melhor" program in Fortaleza or the "Casa Production" in Peru, we have not been very successful in developing such programmes to the needed scale, though this should be further experimented on.

Way forward: development and action-research agendas on financing for UA

Development agenda for finance and urban agriculture

Consolidation of the existing positive experiences should be promoted, while at the same time improving the documentation of lessons learned, and the monitoring and evaluation of impacts to make the concrete and positive results visible and thereby support upscaling and dissemination.

Additionally, the issue of financing of UA should be placed on the agricultural agenda and international debates on development, beyond the circles that it has reached to date and fairly quickly.

Strengthening local experiences including local governments
The first suggestion is to consolidate existing local experiences on credit and investment for UA, in particular those that were documented and referred to in the present study. This can happen through the channelling of financial resources from other sectors or through the implementation of mixed local funds for the UA, and by including the modality of regressive subsidies that provide a bridge to the formal banking sector. The consolidation of experiences in some selected cities will bring about a demonstrative power that could move other cities and actors to become involved.

Building "resource cities" in urban agricultural finance
In addition to consolidating experiences at city level, it is necessary to build the capacities of the actors in these cities so that they become international and national advocates of their experiences. Such consolidated cities could become "resource cities", capable of exporting their knowledge, advising other interested cities and functioning as "on the job training centres". The time is ripe to select a number of cities and to contribute to building the capacities of the different actors involved.

Lobby at international level


Azage Tegegne
Members of the Dairy Association bring their milk to the delivery station in Debre Zeit town, Ethiopia,

Several local government initiatives in financing UA have been active and successful in recent years. Several of the documented cases provide evidence to the determining and positive role local governments in UA. It may be timely to bring these experiences to the international arena. One possibility is establishing close relations with the Forum of Local Authorities for Social Inclusion (FAL) which meets usually at the same time as the World Social Forum of Porto Alegre and of its regional forums such as the European Social Forum or the Social Forum of the Americas.

So far, the FAL is a loose gathering of around 400 local governments, namely those dealing with inclusion and participatory democracy. In addition, the FAL became the first commission (on social inclusion) of the newly established World Association of Cities and Local Governments (Barcelona 2004).

Dissemination of the lessons learned from the experiences of the "resource cities" to the cities associated with the Forum of Local Authorities for Social Inclusion, as well as to other local government forums, should be a priority.

It may also be useful to use WUF 2006 as an event to present research findings related to the agenda suggested below. The appropriation of the findings by the academic and scientific community dealing with urban agriculture and finance issues are important for the future.

Urban agriculture and its contribution to the Millennium Developments Goals
For local or international actors to provide further financial support to UA, it would be necessary to identify the trade offs of supporting investment in UA rather than other activities, as well as to monitor its impacts, amongst others, on improved livelihoods, social inclusion, local economic development and environmental management. In a recent paper (Cabannes,

2004b), a preliminary effort was made to identify how and to which extent UA is contributing to the Millennium Development Goals (in terms of its outcomes) and to good governance in terms of the processes that it entails (see also Chapter 1 of this book). Measuring these contributions in qualitative and quantitative terms is essential to justify financial support to UA and to target it to the different types of UA.

An action-research agenda on Urban Agriculture finance

In addition to the issues highlighted in the analysis of the case studies, the following areas could become part of an action-research agenda to continue developing knowledge and supporting the development of expertise and capacities, which a wide range of actors (from government to producer groups) need. With such knowledge and expertise, these actors can devise and improve the means and ways for UA to make our cities better fed, cleaner, safer and more liveable:

1. Capture the full economic value of using intra and periurban space for agriculture, aquiculture, animal husbandry and forestry

Capturing the urban value of cultivated land refers to the valuation of the benefits, opportunity costs and costs avoided through UA in our cities, not only in **economic and monetary** terms, but also in **social** terms (health, safety, sense of community, preventive inclusion of youth), and in **environmental** terms (productive green spaces, reduction of contamination, dumping, squatting, increased waste recycling). This is important for governments and society in order to justify financial support to UA. The economic rationale should go beyond the commercial value and the potential economic rate of return. This thinking supposes a totally different economic calculation that includes notions such as social value and ecological value, which are as significant as economic value. This approach takes a critical view on the conventional liberal economic perspective that often equates the economic value to the commercial value.

Smita Premchander

Produce being brought for sale to HOPCOMS in Bangalore, India

2. Understand and enhance producers' own informal financing strategies

The study and analysis of mechanisms of resource mobilisation by urban farmers referring to **the means and ways through which urban farmers and producers mobilise financial resources and invest in urban agricultural activities** is another understudied area. What are the informal financing mechanisms created by producers to facilitate access to inputs and services which allow them to expand, intensify or diversify their production, and process, store and distribute their products? It is important to know more about this if we are to introduce formal financing mechanisms that would enhance what people arranges on their own. How can the financial assistance to make farmers less dependant on outside resources be transformed over time? Could this be achieved through a community development programme? And what about providing appropriate technical assistance? All these questions need to be examined in combination.

3. Document proven options for optimising the use of public subsidies, issue guidelines and support pilot interventions

One of the outcomes of the research on credit refers to the wide range of levels, types, end receivers, and channels of subsidies related to UA, both at local and central government levels. It demonstrates that subsidies have empowering and leveraging impacts. However, more research needs to be accomplished to optimise the use of public policies for UA. After all, how public policies can best enable urban producers make the transition from full subsidy to mainstream financing (capacity building and intermediaries are important) remains a key question.

4. Implement and monitor innovative fiscal and financial instruments

Fiscal and financial municipal policies are other fields that demand research. Increasing the knowledge on issues such as participatory budgeting and its impact on UA, partnerships with banks and micro-finance institutions, mixed municipal funds, innovative institutional financial set-ups, extending rural credit to peri- and intra-urban areas and fiscal policies are key to increasing the access of urban producers to financing products.

5. Document, advice and test supply contracts between producer groups and large consumer groups

Organisation is critical for small periurban producers to gain recognition, respect, legitimacy and inclusion in policy processes, receive appropriate support, professionalize, be more accountable for their trade, and enlarge their contribution to the local economy, through partnerships and alliances with a range of rural and urban actors. These alliances allow, among other benefits, the produce and products of urban producers to reach various consumer markets. UA is well placed to cater to important niche markets in cities. What is and can be the role of public institutions (schools and others), consumers' associations, private sector business in financing UA, for example, through direct buying of primary or processed produce (on farm, in food boxes, for canteens etc.)?

6. Comparative advantage of financial intermediaries

In this chapter, several institutions of financial intermediation have been identified and described: public sector intermediaries, private agencies and community-based institutes. Having made this typology, a comparative study of the advantages and the limits of each of these models should be done to further strengthen the current experiences.

The following is an agenda that was adopted during a panel event organised as part of the World Urban Forum 2004 in Barcelona (see Box 4.2). Further inputs in crafting and implementing this action-research agenda that will lead to successful credit and investment programmes for UA and that will ensure their inclusion in local, national, and regional agendas, are welcome.

Micro-credits for income generation and job creation

The fast and massive expansion of MFIs - Micro Finance Institutions- and of the financial resources available for micro-enterprise development has scarcely benefited UA producers. To find modalities to tap these resources for the benefit the urban farmers presents a decisive shift for the expansion of the sector. Experiences in Quito-Ecuador showed the willingness of credit cooperatives to finance market-oriented activities of urban farmers and farming groups, especially when other organisations stepped in to support these activities through training, technical assistance and social organisation.

Promoting UA as part of new urban development models

As a final remark, we want to stress that financing urban agriculture cannot be separated from promoting an urban development model, where local economic development goes hand in hand with respect for the environment and social inclusion and justice for all.

The rationale of financing urban agriculture, and its expansion and success, lies in its integration into sustainable development models that aim to respond to the needs of a growing urban population for food, jobs and recreation and provide "rights to the city for all".

Box 4.2 *Panel event on credit and investment for urban agriculture*

An international panel on credit and investment for urban agriculture was organised during the 2004 World Urban Forum (WUF 2004) by the International Development Research Centre (IDRC), IPES-Promotion of Sustainable Development and the Urban Management Programme for Latin America and the Caribbean (UMP-LAC), with support of ETC-RUAF and the International Centre on Urban Management (CIGU). Experts in urban and financial issues, researchers, and decision makers shared information and experiences about innovative forms of UA financing. The views of international agencies and local actors about public financing of urban agriculture, micro-credit systems, and farmers cooperatives were presented.

The panel aimed to:

a. Report and debate with the participants on some innovative ways, which cities have been using to finance UA so as to better understand the trade-offs of supporting investment in UA rather than other activities, and the role that different forms of financing play in developing UA,
b. Situate these local innovations within the broader context of urban development and discuss how local experiences can be successfully upscaled, and
c. Share with and invite the participants to develop, based on the given presentations, an action-research agenda that will lead to successful credit and investment programmes for UA.

This action-research agenda will continue to be refined and developed over the coming months. Progress made will be reported upon during the 2006 World Urban Forum in Vancouver. Canada.

Hundreds of millions of the urban poor are already practising UA to reduce their food and financial insecurity, to relate with the urban economy and urban environment in a more socially-inclusive way, as well as to build better governance. Governments and financial support institutes can tap into this creativity and energy to build more self-reliant food systems, healthier communities and more productive local economies. The signs are that more and more of them are taking this route.

Notes

[1] The Graph was prepared with the help of the author of the case study. For a complete description, see Mosha, A.C, (2002)

[2] For more information on participatory budgeting and a comparative analysis that includes Rosario, see Cabannes, Y. (2003)

[3] For further information on this innovative experience, see Centre for Micro Finance (2002)

[4] For a description and critical analysis of the Prove experience of credits to home based producers in Brasilia Federal District, see the following working paper written by one of the key players and moving spirit of this seminal experience: Homen de Carvalho, João Luis, O Prove-Programa de verticalização da pequena produção familiar, Brasilia, Brasil. APROVE, PGU, IDRC, IPES. 2001, 60p.Quito, Cuaderno de Trabajo N° 83, Programa de Gestión Urbana (UN Habitat / UNDP).

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Credit and Investment in Urban Agriculture in Nepal

Roshan Shrestha

Nepal is a landlocked country sandwiched between China and India. About 80 percent of the Nepalese population depends on agriculture, which is mainly based in the rural areas.

Due to the high rate of urbanisation, most of the arable land of Nepal's capital city Kathmandu is occupied by housing infrastructure and agricultural production has thus been reduced. At present the population of Kathmandu Metropolitan City is estimated at 701,962 (2001 census) with a per capita income of US$ 360. Cultivation of rice, wheat and vegetables within the metropolitan area continues on a small scale. Some inhabitants are also involved in cow and buffalo keeping for milk production, for their own use as well as for sale.

Kanhaiya Sapkota

There is no strict division of tasks in periurban agriculture

Most of the arable land on the city's fringes is used for agriculture (rice and wheat cultivation), horticulture, poultry farming and bee keeping on a larger scale, the products of which are processed (jam s and pickles) and sold at local markets.

Nepal is a predominantly agricultural country. The government has formulated a 20-year Agriculture Perspective Plan (APP) in which the development of advanced technology and infrastructure for achieving high agricultural production is emphasised as one of the main objectives. The national policy recognises micro-finance as an important means of reducing poverty and achieving economic growth. However, the need for micro-finance investment in urban and (peri)urban agriculture is generally not recognised, though there are some (peri)urban based micro-finance institutions, including member-based saving and credit co-operatives, which provide micro-finance services to members / clients for (peri) urban agricultural activities.

Two credit and investment schemes

Mahila Prayas Savings and Credit Co-operative Ltd. (MPSACCO) is a women-only cooperative that has adopted two types of lending methodologies: individual lending and peer lending. Samudayik Savings and Credit Co-operative Ltd. (SSACCO) is a mixed membership cooperative that has individual lending only.

Individual lending is characterised by:

- loans that are guaranteed by savings and / or co-signatories (in the case of SSACCO, loans are guaranteed by co-signatories for amounts up to Rs.20,000 (US$260)) and / or by physical collateral (for loan amounts more than Rs.20,000 (US$260));
- potential clients who are screened by credit checks and character references;
- loan amounts that are based on thorough viability analysis;
- loan sizes and terms that can be tailored to needs of the business within a maximum limit;
- staff of the lending institution who work to develop close, long-term relationships with members.

Peer lending has the following characteristics:

- loans are mutually guaranteed by other members in the group;
- potential clients are screened by their peers;
- loan approval is based on the scheme presented;
- loan size and terms are determined by the nature of the business;
- staff of the lending institution has a distant relationship with large numbers of clients; and
- peer groups are used to reduce staff workload.

MPSACCO has individual lending in urban areas and peer lending in the periurban areas. The cooperative has different kinds of savings schemes like regular savings, voluntary savings, marriage savings and festival savings. Each member deposits Rs.100 (US$1.30) every month as *regular savings* (or in the case of group savings, each group collects money from its members), for which the cooperative provides 12 percent interest rate. One can further deposit any amount at any time on a voluntary basis, for which the cooperative provides a 9 percent interest rate. Similarly, a member can save for marriage and for a particular festival. She cannot draw on these savings for other purposes. The cooperative provides 12 percent and 9 percent interest rates for marriage savings and festival savings, respectively.


Kanhaiya Sapkota

Transporting vegetables to the market

SSACCO has only one kind of savings, compulsory savings, for which each member has to deposit at least Rs.100 (US$1.30) per month at a 10 percent interest rate. According to the records, the members have deposited Rs.100 (US$1.30) to Rs.500 (US$6.50).

Members' savings are the main source of capital for these cooperatives. Other sources of capital of MPSACCO are:

- a *revolving credit fund* of Rs.375,000 (US$4,870) provided by the Asian Development Bank funded Micro-Credit Project for Women, disbursed only to group members in Kathmandu, and
- *loans* of Rs.200,000 (US$2,597) under the Self-Reliance Fund of Nepal Rastra Bank, a central bank of Nepal, at a subsidised interest rate, invested only in group members in the periurban area of Kathmandu, Rs.500,000 (US$6,493) from the Nepal Federation of Savings and Credit Co-operative Union at 17 percent interest rate and Rs.325,000 (US$4,221) from Aaincho Paincho, a Multinational Financial Institute, at a 14 percent interest rate.

Most of the members of MPSACCO in periurban areas use credit for agricultural activities such as buffalo / cow / goat raising, poultry farming, vegetable cultivation, millet cropping, bee keeping and nursery management. In addition some group members have opened shops. The urban members of MPSACCO use the credit for opening shops. Some members purchase vegetables from the wholesale market and sell these at retail prices in the local markets.

Ladyfinger cultivation along with corn cropping

The members of SSACCO have predominantly invested in agricultural activities like buffalo / cow / goat raising, poultry farming and vegetable cultivation, using the credit. The milk produced by the members is partly sold in the local areas and also supplied to the collection centres, giving reasonable profit. Some members have invested in shops.

MPSACCO has both short-term credit, provided for six months, and long-term credit, provided for 18 months. The minimum loan size is Rs.5,000 (US$65) and the maximum loan size is Rs.50,000 (US$649). The cooperative charges 18 percent interest rate to the urban-based members, who join as individual members, whereas it charges only a 16 percent interest rate to the periurban based members. In the case of individual lending, members who know the borrower have to be the guarantor. Clients, who live in a rented house, must have the house owner as the guarantor in order to receive individual loans. However, in the case of peer lending, group members have to be the guarantor.

There are different types of repayment procedures provisioned in the cooperative. Some repay the instalment each month (for household consumption or running a shop), some repay every three months (for vegetable cultivation) and some repay every six months (for livestock raising). Loans issued for poultry farming can be repaid at three-monthly or six-monthly intervals.

SSACCO has only one loan term, in which the borrower has to repay the loan within one year in different instalments. Instalments can be monthly, bi-monthly and quarterly within a year. The cooperative provides a minimum loan size of Rs.8,000 (US$104) and a maximum loan size of Rs.50,000 (US$ 649). Members have borrowed Rs.8,000 (US$104) to Rs.15,000 (US$ 195) for vegetable cultivation and about Rs.50,000 for buffalo raising, cow raising, poultry farming and opening a shop. SSACCO charges 18 percent interest rate on the loans provided to its members. If a member takes a loan less than her or his savings in the cooperative, then the cooperative charges only 16 percent interest rate. To borrow an amount up to Rs.20,000 (US$ 260) another member of the cooperative should be a guarantor. Members have to pledge their land ownership certificate as collateral to get a loan of more than Rs.20,000.

Recommendations

- With effective and efficient management, the member based savings and credit co-operative model could be a viable model for providing sustainable micro-finance services to the members as it has its own resource base to meet its operational and financial costs.
- Diversification of savings schemes in a member-based cooperative supports its capital formation. Credit should be combined with savings as savings could work as collateral to some extent. Diversification of savings schemes also addresses the various needs of its members.
- Financing family businesses generates more employment (for all family members) and is more sustainable than financing individual businesses.
- Peer lending is more sustainable and inclusive in terms of reaching the poor and women, since it emphasises group membership and adopts the mechanism of group screening. This minimises risk and saves costs in terms of time and money.
- Credit schemes should incorporate agricultural training to the members. For this, the cooperatives should seek support from local governmental bodies, municipalities, donors and international NGOs.
- The central and local government should link urban farmers with international NGOs and donor agencies and create an urban environment that attracts private investment. The government should further promote urban farmers' organisations, especially of women farmers and / or vulnerable groups. Tax incentives to the members of the schemes would motivate people to be involved in agricultural enterprises.
- NGOs should provide training and seed capital to urban farmers (members of the cooperatives). In this regard they should take the urban farmers' organisations (eg., cooperatives) as partners.

- Farmer organisations should include cooperatives as part of their network, and assist in technology transfer among its members, organise workshops to share knowledge and skills. Exposure visit programmes among its members could also be organised to learn new and innovative agricultural techniques.
- The responsible authorities should facilitate the supply of agro-products from urban farmers to the markets, through collection centres and provision of information regarding availability of finance, inputs and product demand.

Note

This case study was undertaken for IDRC, UMP-LAC and UN-HABITAT in 2003. The article appeared in UA Magazine no. 9, 2003. Both, the article and the full paper are available at www.ruaf.org.

Focusing credit on urban agriculture in Gaborone, Botswana

A.C.Mosha

The city of Gaborone, with a population of 225,000 in 2001, has grown from a very small village to become the capital city of Botswana in a period of less than 36 years. Still, subsistence and commercial agriculture are both found throughout Gaborone and Greater Gaborone.

While poverty in Botswana is predominantly rural, the rate of urbanisation (at 8.4 percent per annum) is the highest in Africa. Rural migration has led to increasing concerns about social and physical changes in urban areas. One of the safety nets adopted by the poor has been urban agriculture either as a means of survival or to supplement low incomes, while some entrepreneurs have opted for urban agriculture as a means of making money. Poultry (40 percent), horticulture (20 percent) and piggeries (10 percent) dominate the activities taking place in the city. There is a gender bias in favour of women within this sector. A key problem to further development of urban agriculture is the lack of financial support.

Credit and Investment for UA Interventions

The Botswana government has a long history of assisting the entrepreneurial development of businessmen and women through various schemes and programmes; it also provides credit in the form of outright financial grants, loans, inputs (machinery, seeds and seedlings, etc.), as well as other financial subsidies. In addition, NGOs and donors have mainly invested in the poor, while the private sector has provided credit for commercial farms in many areas including periurban areas. Of the various programmes, three have achieved some marked success in urban and periurban agriculture. These programmes will be examined in depth and evaluated further in this paper.

Alice Hovorka

Participation in commercial urban agriculture in Greater Gaborone is gender balanced

The Arable Lands Development Programme (ALDEP)

The ALDEP was conceived in 1977 and has gone through several phases since then. It provides assistance to needy farmers who are capable of increasing production and household income, the prerequisites for eligibility being the number of cattle they own and their yearly income. The assistance packages provide the approved applicants with an 85-90 percent subsidy for fencing materials, water tanks, agricultural tools and inputs and cattle. These conditions have been conducive enough to attract a great number of citizens to be farmers, but only with minimal involvement in farming.

In the Gaborone area, the target was to reach 11,388 individuals, but to date only 5,484 farmers have been reached (48 percent). Packages received vary from a low of US$ 852 to US$ 4,326 per farmer (GoB,1999). The ALDEP has not been able to significantly improve the performance of urban and periurban farmers as they usually cultivate only small patches of land (GoB, 2000). At present, the ALDEP appears to be more of a welfare programme rather than a development programme.

The Financial Assistance Programme (FAP) (1982-2001)

The FAP was introduced in 1982 as an incentive and subsidy programme aimed at creating employment and encouraging investment in a range of economic activities, including agriculture. The FAP has been a significant catalyst in increasing urban agriculture. Funding has been given for setting up of chicken or horticultural farms, rearing of animals, etc., and is used to purchase inputs, and to help pay for training and other costs. Women were given priority in the disbursement of grants; hence, 82 percent of the beneficiaries were women.

The total amount of FAP grants provided to commercial periurban and urban farmers in the Gaborone area is approximately P3,000,000 (US$ 500,000). The grants fall within the small- and medium-scale sectors, which support enterprises with investments in fixed assets of less than P75, 000 (US $ 12,500) and between P75, 001(US$ 12,500) and P200,000 (US$ 33,333), respectively. In a recent study by Hovorka, many respondents noted the FAP as a major incentive to start up agricultural production. Those not receiving FAP assistance had bank loans or lines of credit, while the remainder used personal savings for financing their agricultural operations (Hovorka, 2001).

Citizen Entrepreneurial Development Agency (CEDA)

In 2001, the government of Botswana shifted from the policy of issuing **grants** under the FAP to giving **loans** under the CEDA Programme. The financial assistance provided by CEDA is in the form of loans at subsidised interest rates as opposed to outright grants. This is meant to be a "soft window" for citizens wishing to start or expand business operations and to buy into existing businesses.

Since the project is quite new and still trying to find its feet, it is difficult to make an evaluation of its impact in terms of benefits to the agricultural sector in the study area of Gaborone and its environs. However, up until the end of 2000, 229 applications had been accepted in principle, totalling P139 million (US$ 23 million). Of these, 22 were urban and periurban agricultural projects (Botswana Guardian, 26 April, 2002).

Alice Hovorka

Support to small businesses is important.

The minimum size of the loan for small projects is P5000 (US$ 900) and the maximum is P150,000 (US$ 25,000). An interest rate of 5 percent per annum is charged on the loans. Repayment periods vary according to the size of the loan and the project cash flow, with a maximum repayment period of 60 months or 5 years, with some flexibility for projects of a special nature (urban and periurban agriculture included).

For medium-scale projects the minimum size of the loan is P150,001 (US$ 25,000) and the maximum is P2,200,000 (US$ 445,000). An interest rate of 7.5 percent per annum is charged on the loans. Repayment periods vary according to the size of the loan and the project cash flow, with a maximum repayment period of 84 months or 7 years, with some flexibility for agricultural projects.

Assistance for large projects (such as big chicken, dairy or pig farms) takes on the form of equity capital and / or loan and management assistance. This is provided under the Venture Capital Fund. However, promoters are required to contribute a minimum of 25 percent of the total project cost as equity and to pay market-related interest rates.

Other schemes

There are also private banks providing some credit to farmers. The African Development Bank is active in assisting producer groups in agriculture and other sectors involved in economic empowerment projects. However, their role is limited, because they are reluctant to lend money to agricultural projects as they consider agriculture as a high-risk sector.

The Women Finance House is an NGO that gives limited loans to agricultural projects at 4 percent interest. These are payable within 6-12 months. These are meant to assist women and are extended to individuals.

Lastly, the Department of Cooperatives has a Central Cooperative Fund that cooperatives can draw on to assist their businesses. They are required to repay the money so that others can also benefit (acts like a revolving fund). These cooperatives, most of which are dominated by women, have attracted funding from other government departments like Women Affairs that have resources for funding women's groups, as well as from international organisations like the Canadian, American, German and Norwegian embassies. Producer groups exist mainly in the horticultural sub-sector. Poultry, Piggery, Small stock and Dairy also exist.

Analysis of the Different Schemes

The government has slowly shifted from giving outright grants or a mixture of grants and loans (as in FAP, and ALDEP) to giving loans (CEDA), which are well-monitored and controlled through a bank, and impose (subsidised) interest rates.

Financial Grants were the hallmarks of the FAP, and to a lesser extent the ALDEP. Such grants are useful in situations where the people are extremely poor and cannot raise credit through the formal or informal systems. However, a reliance on grants leads to complacency and can in the end kill the spirit of self-reliance, as with some people who took FAP grants as a free-for-all financial handouts.

Loans are the only financial assistance mechanisms that have sustainability in the long run. Obviously, they suit middle- and high-income earners. People are encouraged to work hard in order to pay back such loans. This is the new philosophy of CEDA.

Input supports *in agriculture like tractors, seeds, fertilisers, etc. (e.g. under the ALDEP) are justified when prospective farmers cannot afford to buy them. Targeted inputs can be quite effective in getting people started.*

Tax incentives are useful in attracting major investors to agriculture and manufacturing. If properly targeted and selective, they can be very effective in creating employment and incomes. However, the time factor should not be more than 3-5 years; otherwise they can be abused as in the case of the large-scale FAP grants / loans and CEDA loans.

Cooperatives can be quite an effective means of getting people started in urban agriculture. The government, donor agencies, and NGOs find it better to lend to cooperatives than to individuals. It is suggested that the Cooperative Bank should be resurrected and that the government should intensify the promotion of institutional Savings and Credit Cooperatives.

Conclusion and Recommendations

Institutional cooperation is needed. The different institutes and programmes should interact and collaborate to improve credit services for (peri-)urban agriculture. Some effort should be made in order to connect the above described initiatives and to focus on the one(s) that would have the best comparative advantages. Also the accessibility of these schemes for poor urban farmers should be studied in order to develop specific credit lines.

Flexible credit-support systems should additionally be put in place to provide farmers, especially small-scale farmers, with market information and support, and training in basic bookkeeping, business skills and marketing.

Under market forces, urban farmers will be squeezed out; hence, measures such as zoning, price subsidies, and relaxing some of the stringent town planning and environmental laws are necessary and should complement financial support.

This case study was undertaken for IDRC, UMP-LAC and UN-HABITAT in 2003. The article appeared in UA Magazine no. 9, 2003. Both, the article and the full paper are available at www.ruaf.org.

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Securing Funds through Municipal Participatory Budgets: the experience of Porto Alegre, Brazil

Saya Saulière

Porto Alegre is the capital of the state of Rio Grande do Sul (Brazil), and has 1,340,590 inhabitants (IBGE, 2000). It is the second state capital in the country with the largest sub-urban area, representing 30.56 percent of the city's land surface 17,116 ha (SMIC, 2002). Of this area, 60 percent is used for horticulture, fruit growing and cattle keeping. According to the 2002 statistics (EMATER), there are close to 600 farmers in the area.

Participatory Budget

Porto Alegre is internationally known for its innovative management strategies. One of the pillars of local democratisation was the implementation of a Participatory Budget[1], a democratic process of popular participation, under which the population directly decides how to allocate public funds for works and services to be executed by the municipal administration. Organising the Participatory Budget and getting it operationalised took several years. Under the administration of the previous government (2000-2004), it worked as described below.

The city is divided into 16 regions, based on geographical, social and community organisational aspects. On this regional basis, the population expresses its needs and highlights four priorities within 13 existing themes every year. Within each theme, the work to be carried out and the services to be performed are prioritised. In addition, six technical committees operate city-wide to extend participation to other social actors previously not involved in the Participatory Budget (i.e. union members, merchants, businessmen, farmers, students). These committees are able to go beyond a restricted neighbourhood vision and think at the scale of the city. The committees decide on sector investments to city organisation and urban and environmental development; traffic and transport; health and social welfare; education, sports and leisure; culture; and economic development and taxation. The city administration organises a large plenary meeting of the community each year.


Saya Saulière

Honey processing at the Casa do Mel, in Porto Alegre, Brazil

Over the past years, four urban agricultural initiatives were financed by the PB, and prioritised by the Thematic Economic Development Committee.

Fishermen's Cooperative

The city of Porto Alegre lies on the banks of the Guaíba River. In 1999, the fishermen of the islands (Ilha da Pintada and others) established the first fishermen's production and service provision cooperative in the state of Rio Grande do Sul, *Coopeixe.* In the same year they applied to the Thematic Economic Development Committee for funds to construct a fish collection centre (located in the periurban area). The construction of this building would allow them to collect the entire fish harvest at one location and to handle and clean the fish according to health regulations; the building was also supposed to serve as a supply centre. The monetary investment was approximately 350,000 Reales (**2**). Currently, the cooperative has 230 members. Fish is sold at markets, to restaurants and directly to consumers. This experience with the municipal participatory budget prompted the cooperative's members to go further and participate at state level. In 2000-2001, the state's fishermen got organised and applied for funds to purchase material (nets and vessels), securing 150,000 Reales from the Thematic Agriculture and Supply Committee.

Casa do Mel of the Gaucha Bee-keepers Association

The Gaucha Beekeepers Association (AGA) was created 40 years ago, and currently has 80 members in Porto Alegre. One of the biggest problems faced by the association's beekeepers was the processing of honey. In 1995, the members applied for and obtained approximately 70,000 Reales from the Participatory Budget's Thematic Economic Development Committee to build a *Casa do Mel* ("Honey House"). The association bought equipment for the house (30,000 reales) using a percentage of the proceeds from the honey sales. The house was inaugurated in 1998. In 2002, the association decided to apply for more credit to build another processing unit and a structure for the collection of honey as an extension to the current honey house. Products currently processed in Casa do Mel bear the federal health control seal, which allows them to be exported. The honey produced by the association is sold at a kiosk assigned by the municipality and located in the centre of Porto Alegre and also at fairs. The association does not want to sell its honey in supermarkets as it would then be sold at higher prices, which the members believe is not correct from a social point of view. In 2002, 15 tonnes of honey was produced.

The Fishermen's Cooperative

Pig Farmers' Association

In the 1990s, urban pig farmers in Porto Alegre used to collect the city's unsorted garbage and sort it at their homes, separating out the organic matter to feed their pigs. However, these practices were harmful to the environment. To solve this problem, the Municipal Department of Urban Sanitation (DMLU) implemented a project whereby organic waste was sorted at the source, and thereafter collected and distributed to producers. In return, the 15 producers involved in the project supplied two day-care centres (200 children) with non-perishable food worth 500 Reales every month. Currently, the organic waste is collected at 35 facilities (mostly hospitals and some company cafeterias) with an average of 7 tonnes/day to feed 1,700 pigs. The DMLU is responsible for the collection and transportation of the waste to a distribution centre, located at the house of one of the pig farmers. At the start of the project, the 15 producers were not organised in an association. They decided to form the Association of Pig Farmers of the Southern Zone to be eligible to submit an application to the Participatory Budget. In 1996, they applied for and obtained from the Thematic Economic Development Committee funding to purchase a machine to crush and sterilise organic waste. This year, the members plan to apply for funding to the PB to construct an agro-industrial facility to slaughter the animals and process the meat.

Agro-industry within a tourism project

The rural community association of Belem Velho is developing an agricultural tourism project that includes treks to nearby areas, visits to farms, etc. The members wish to process local products and sell them to the tourists. In 2002, they applied for and obtained from the Participatory Budget's Thematic Economic Development Committee 10,000 Reales for the construction of an agro-industrial facility. Either this year or the next, they hope to apply for more credit to build shops within the association's facility in order to sell local products.

Reflections

In Latin America, since the first PB in Porto Alegre in 1989, there is an exponential increase in the number of local governments undertaking PB. In 2005, more than 1400 local governments have worked with PB, most of them located in Peru where a national law enforces local governments to define their budget in a participatory manner.

PBs in LA are diverse in terms of the budget allocated, the level and forms of citizen's participation and the methodologies used (Cabannes, 2004). For example, the methodology used in Porto Alegre induces the selection of paving, sanitation, health, and education projects in regional committees, while urban Agricultural projects can be financed only through the Thematic Economic Development Committee. In Peru, the PB methodology used facilitates the selection of various local economic development projects in territorial assemblies. This methodology facilitates the funding of agricultural projects such as small agro-industries (producing cheese, cacao), food security projects, agricultural cooperatives or fish farming.

Urban farmers have to be organised and be part of an association in order to obtain funds through the Participatory Budget. As the number of representatives from the same association in meetings and assemblies to apply and advocate for their requests increase, the chances of succeeding also increases. It is evident that the likelihood of getting funds provides a significant incentive for farmers to join forces (*Coopeixe*, Pig Farmers' Association) or to strengthen their organisation (*Casa do Mel*). During the meetings where the prioritisation of investments is discussed, arguments used by farmers in submitting their requests are always focused on social benefits and gains for their communities.

Farming activities supported by the Participatory Budget in Porto Alegre are diverse and the granted funds range between 10,000 and 350,000 Reales. In the cases mentioned, the Participatory Budget was the only way for producers to obtain funds for their activity. In the case of *Coopeixe*, the PB allowed them to build the infrastructure, without which the cooperative could never have existed.

Urban farmers obtain funds through the Participatory Budget to support production (machinery and materials), supply and processing (infrastructure and equipment for agro-industries). They are also considering applying for funds to support commercialisation (shops).

The participation of farmers and fishermen in the Participatory Budget opens communication channels with the municipal government, which allow for other types of collaboration (sales points, service provision for municipal events, possibility to profit from complementary training). In some cases, members of organisations provide social services in return.

Notes

[1] For informaation on the participatory budget, see: www.portoalegre.rs.gov.br/op
[2] In March 2003, 3.35 Reales was US$1.

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EMATER Empresa de Assistencia Tecnica e Extensao Rural do Estado
IBGE, Instituto Brasileiro de Geografia e Estadística
SMIC, Secretaria Municipal da Produção, Indústria e Comércio

Resources

Micro-credit and investment for urban agriculture/Microcrédito e inversión para la agricultura urbana.
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In 2002-2003, a systematic survey and evaluation of significant and diverse modalities of credit and investment provision to urban agriculture was implemented and co-ordinated by UN-Habitat through its Urban Economy and Finance Branch (Nairobi, Kenya), its Urban Management Programme for Latin America and the Caribbean (UMP-LAC), its Regional Anchoring Institution IPES- Promotion of Sustainable Development as well as the International Development Research Centre (IDRC). The project identified, typified and analysed 13 experiences (case studies) in different cities of Latin America (3), Africa (4), Asia (3) and Europe (3). A comparative analysis of the case studies was included in a synthesis paper, elaborated by IPES and UMP-LAC in cooperation with the Centre for the Promotion of and Employment in the Urban Informal Sector (CEPESIU -Ecuador). The document is available in both English and Spanish.

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The above-mentioned initiative was further supported with additional cases by RUAF. Fifteen of these cases were incorporated in issue 9 of the UA-Magazine, which can be downloaded from www.ruaf.org.

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An in-depth process of consultation and field testing, reflection, and improvement has gone into this manual. The process was led by a core team of the SEEP Network – a private voluntary organisation (PVO) of practitioners. It had supplementary guidance of AIMS researchers and USAID, and it engaged NGO practitioners of micro-finance (in six sites around the world) as testers, trainees, and early users. The document that has emerged out of this pool of diverse experience and skills is one that describes several critical advances in the practice of mid-range
impact assessment.

CD-Rom International Panel on Credit and Investment for Urban Agriculture (English and Spanish)
An international panel on credit and investment for urban agriculture was organised during the 2004 World Urban Forum by the International Development Research Centre (IDRC), IPES-Promotion of Sustainable Development and the Urban Management Programme for Latin America and the Caribbean (UMP-LAC), with support of ETC-RUAF and the International Centre on Urban Management (CIGU). Experts in urban and financial issues, researchers, and decision-makers shared information and experiences about innovative forms of UA financing. The views of international agencies and local actors about public financing of urban agriculture, micro-credit systems, and farmers cooperatives were presented. The presentations made by this panel, accompanying background papers, lessons learned and the elaborated action agenda have all been put together on a CD-ROM. The CD-ROM is available in English and Spanish.

www.uncdf.org/english/microfinance/index.html
The United Nations Capital Development Fund (UNCDF), through its micro finance programmes, supports a variety of initiatives that facilitate the provision of financial services to the poor. A joint unit of UNDP and UNCDF established in 1997, called the Special Unit for Microfinance (SUM), is now fully integrated into UNCDF, and is considered the lead technical unit on all matters pertaining to micro-finance in the UNDP Group.

www.microfinancegateway.org
The Microfinance Gateway is a public forum for the micro-finance industry at large that offers a wealth of tailored services for micro-finance professionals, including resource centres on specific topics in microfinance, a searchable library of electronic documents, a consultant database, a jobs listing service, and specialised discussion groups.

www.fao.org/ag/ags/agsm/biblio.htm
These pages of the FAO web site allows access to the Bibliography on Agricultural Credit and Rural Savings, Second Series No. 10 prepared by the FAO Rural Finance Group, in collaboration with the Department of Agricultural Economics at The Ohio State University (OSU), USA.

www.gdrc.org/icm/icm-bibliography.html
This library on micro-credit of the Global Development Research Centre contains 810 entries. It gives you categories such as Newsletters on Micro Finance, Islamic Banking and the Urban Informal Sector. Also of interest is the page *http://www.gdrc.org/uem/index.html* on Urban Environmental Management.

Chapter 5

Gendering the Urban Agriculture Agenda

Urban agriculture has been embraced and promoted by the international development community as a means for urban dwellers to achieve sustainable livelihoods and socio-economic advancement. Many low-income households who farm in the cities gain a more consistent source of food and better nutrition. They can also earn or free up cash for non-food items. Advocacy for urban agriculture was initially focused on the policy agenda, but has moved recently into the realm of municipal development. Now that municipal authorities increasingly recognise this pivotal activity, it is easier for urban agriculture practitioners to integrate it into planning and decision-making mechanisms at the city level. This chapter seeks to make clear why this trajectory must be conceptualised along gender lines, since gender dynamics are central to the form, function, organisation and structure of urban farming.

Gendering the Urban Agriculture Agenda[1]

Alice J. Hovorka
Diana Lee-Smith

Gendered Urban Agriculture

A gendered perspective on urban food security is essential in understanding and explaining dynamics that shape the production and marketing of foodstuffs in and around urban centres. Without exploring the question of what role do women as distinct from men play in feeding cities, researchers, planners, and policymakers risk leaving unaddressed key local and structural issues and processes that shape gender inequities and hinder food supply at multiple scales. Such exploration necessarily counters the invisibility of specifically women's work in conceptualisations of food supply and security that assume food production and trade to be part of women's automatic and everyday duties, related to the domestic sphere, and therefore not important in economic or political spheres.

Women's role in food security

There is a wide consensus that women cook and, in most cases, prepare food. Women also tend to shop or procure the food for eating in the home, which in some cases means growing it in kitchen gardens or keeping small livestock for milk and eggs, for example. In other cases, it means saving some food from produce that they sell as traders. It can also mean that, when drought or economic crisis hits, women feel the pinch most, as they have to find some way to provide for their families, and this can lead them to organise collectively. Regional examples can be cited. The "glass of milk" programme where Latin American women organised to address urban hunger and disease highlights social movements and organisations that have emerged from this association of women and food supply in Latin America. The same applies to Asia, for example, the domestic stove improvement programmes in India (Barrig, 1991; Sarin, 1991). Thus in most societies, even where little or no food is produced within the household, women may be major actors in facilitating domestic food supply because of what Tripp calls the "moral economy" within which their work is located (Tripp, 1997).


Azage Tegegne

Training of women on milking and milk handling at ILRI Debre Zeit Research Station

The strong association of women with subsistence production and the implications for economic development has been recognised for more than thirty years (Boserup 1970). Numerous academic studies have addressed this issue regarding specifically urban areas, including a special issue of the journal *Environment and Urbanization* in 1991 and the International Research Seminar on Gender, Urbanisation and Environment held in 1994 (Lee-Smith, 1994). It is important to recognise the distinction of women's association with domestic food supply, as opposed to men's roles in households as income earners or "breadwinners" when collecting and analysing data on women's roles in food production, including in urban agriculture.

Historical overview

Early research documents women's participation in food production and trade in urban areas, as well as the policy-based impediments to their role in enhancing urban food supply and security. Guyer (1987b) found that, in 1888–1912, women farmers would bring the small surplus they generated from family food production for sale in the town of Yaoundé. Mitullah (1991) describes something similar in early colonial Nairobi, and this is much more extensively treated in Robertson's (1997) work on men, women and trade in Nairobi. By the 1920s and 30s, the colonial division of labour meant men were working as urban or plantation labourers, whereas it was generally women who were farming and bringing in the urban food supply. In Dar-es-Salaam, Bryceson (1987) found urban wage-workers were fed by their wives in the 1930s. In Yaoundé, male chiefs took advantage of this division of labour by "marrying" hundreds of "wives" who constituted unpaid work crews to supply urban food and profits for them (Guyer, 1987b). After independence in the 1960s and early 70s, rural women were both farming and trading to bring food to the city of Yaoundé.

In Kano, Nigeria, Hausa women's food supply remained outside the purview of policy (and official attention) whereas Hausa men's production and sale of staples on a small scale brought them into conflict and competition with large-scale traders and the authorities (Watts 1987). Studies of post independence food supply in both West and East Africa document how food production policies failed to take into account this gender division of labour and actively promoted men as opposed to women farmers (Guyer, 1987; Tripp, 1997). In the 1970s in Yaoundé, women continued to grow food for their families and sell the surplus, though this remained outside the purview of national food and agriculture policy. The national policy focus on rural agriculture may have actually increased urban agriculture production in Dar-es-Salaam according to Tripp (1997). In Dar-es-Salaam, where the women were bringing in food for the men in the early colonial city, only seven percent of labourers had farm plots in 1950. By 1974, when official food supply and distribution systems were in operation, 70 percent of households in an urban low-income settlement had urban agriculture plots, and in 1980 this had increased to 80 percent, with two thirds of the farmers being women. This is attributed to the malfunctioning of the official schemes, which failed to match supply and demand (Tripp, 1997).


Alice Hovorka

Men tend to have access to greater amounts of resources

A little-known but extensive study in periurban Kumasi, Ghana, raises interesting questions about the relationship between gender, land rights and food production (Kasanga 2001). In examining how women have lost out in the control of land in the urbanisation process, even where matrilineal inheritance of land is the norm, Kasanga states that:

> *"There are more women farmers than male farmers in the peri-urban villages. They are also more likely to farm on family lands using a low-input bush-fallow system to grow food crops. These farmers are vulnerable to losing their farms to residential development. They are also constrained by a cycle of low productivity from investing in further farm development." (Kasanga 2001).*

Clearly, the relationship between women's association with providing food for the family as opposed to men's association with growing cash crops, encouraged by official policy and social norms, has led not only to the current data about the prevalence of men in urban farming in Kumasi, but also to the disempowerment of women in a society that traditionally empowered them.

An examination of the role of women as food traders into and within towns reveals a complementary picture, showing how normative expectations of the role of women intertwine with food policies that systematically ignore that role or, even worse, undermine the activities of women food traders or subject them to harassment. In this respect, there is no difference between East and West Africa. Although the association of women with small-scale food trading is reportedly stronger in West Africa, where it is unusual to find men as food market traders, the term "market women" is common throughout the continent. In Kenya she is the "*mama mboga*" (mother vegetables), while in Dar-es-Salaam the term "*mama ntilie*" – meaning "mother put food on the table" – means food selling from temporary kiosks in the informal sector. It is recorded that women formed the majority of vegetable market and street-food traders in several cities including Accra, Addis Ababa, Kampala, Lusaka and Nairobi (Mitullah, 1991; Tripp 1997). Robertson has done detailed historical studies of the origins and development of this trading by women in Accra, Ghana and Nairobi, Kenya (Robertson 1990, 1997).

In 1973, women formed the bulk of food producers and traders for the urban market of Yaoundé. As a form of income and employment, food trading was the main occupation of urban women, and women formed 89 percent of traders, half of them combining trading with food production in "rural" areas. Presumably, this would include periurban or even urban production, since 45 percent of Yaoundé's food came from the immediate hinterland. These women transported their produce by "head-loading" and they owned no vehicles. In 1968 women were accused of being responsible for rises in food prices and in 1972 market price controls were introduced that subjected women traders to harsh punishments. The women were reported to think high-class people wanted merely to exploit them, but they had no political voice. Those who did have a voice claimed women have "an obligation to feed us" and created a "disloyal competition" to trading through the official channels. Food production was supposed to be done by men farmers in rural areas, and trade though the unsuccessful MIDEVIV initiative (Guyer, 1987b).

In Dar-es-Salaam, women were not food traders in the 1930s, according to documentary sources, merely bringing food for their families but, by the 1980s, 69 percent of adult women were self-employed traders, and only nine percent were in wage employment. It is worth noting the breakdown, 50 percent of married women being self-employed and only three percent in wage employment. Women were the major players in the explosive growth of the informal sector of the economy, and they in fact produced in and around mainly in food, specifically vegetables, fruit and cooked foods. Much of the food was in fact produced in an around the city, with "markets for selling urban produce" being categorised as one of four main activities of the "parallel markets" identified at the time. This must be contrasted with the assumptions, at the time of liberalisation of markets in the 1990s that urban food was coming from rural areas (Tripp, 1997).

Azage Tegegne

Milk marketing in Ethiopia

As in Yaoundé, but a decade later, there was much harassment of women traders in Dar-es-Salaam, especially the poorest, who were classed as "economic saboteurs" in the early 1980s. Women were rounded up and taken to detention centres. They had to produce certificates of employment or marriage – the assumption being that women must be dependants of employed men. All this ran counter to the facts documented by researchers that women formed the majority of entrepreneurs and earned higher incomes than employed men.

Many married women were supporting their households, as men's wages were very low (Tripp, 1997; Tibaijuka, 1988). The policy was clearly counter-productive and, by 1986, a statement was released that informal sector traders should "come out of hiding" – an ironic comment no doubt since it referred to 95 percent of the city's population. By the mid 90s, the policy climate had changed, with support for the informal sector and women traders being established. By this time, women had set up organisations and networks, giving them some greater political cloud. However, formal plans and policies still fail to take account of the way women's businesses are run, as part of their work in household maintenance and not simply as profit-making enterprises. Women's work continues to be disadvantaged (Tripp, 1997).

Azage Tegegne

An urban dairy farmer in Addis Ababa

Claire Robertson's studies of women food traders in Accra in West Africa and Nairobi in East Africa contain meticulous ethnographic and historical information on how such patterns of behaviour, power and control operated. She focuses on the perceptions and reactions of the women themselves, and traces how they have responded by organising as collectives and by finding an increasing political voice (Robertson 1990, 1997).

Contemporary trends

Contemporary research on gender and urban agriculture documents clear gender dynamics in food production and trade in and around cities. There is now quite extensive case-study data on the prevalence of women as urban farmers in East and Southern Africa whereas, in West Africa, more men than women are found in urban agriculture as a rule. Thus, women predominate among urban farmers in Uganda, Kenya and Namibia, for example, whereas men predominate in Ghana and Nigeria (Obuobie et al., 2004; Kessler et al., 2004). Studies from Port Harcourt, Nigeria, and Senegal, however, note that women predominate as agricultural labourers and men as owners of horticultural enterprises (Oruwari, et al. 2004).

In Latin America, the pattern appears equally diverse, with women forming the majority of urban farmers in Rosario, Argentina (where emergency strategies in the face of economic crisis prevail) and men in Lima, Peru (where men are traditionally the cultivators). However, as articles in the issue of the *Urban Agriculture Magazine* devoted to Gender and Urban Agriculture show, things are changing in Lima as part of ongoing interventions and organised action by women themselves (Hetterschijt, et al. 2004). Little information is available from Asian cases, but the study from Nepal in the above-mentioned issue indicates periurban farming in Nepal is a family activity, with men and women playing different roles, but men controlling the land and the surplus production. The same appears true in Kolkata, India, where there is again a division between women's unpaid work and men's (assumed) role as income earners (Mukherjee et al., 2004; Sapkota, 2004).

Generally speaking, while both men and women are active participants in urban farming, the nature and extent of their participation varies in different contexts. The predominance of women urban farmers in many parts of Africa, for example, is ascribed to the fact that women still bear the main responsibility for household sustenance and well-being. Women also tend to have lower educational status than men and therefore more difficulties in finding formal wage employment (Hovorka 2005). At the same time, the predominance of men urban farmers in many parts of Asia is attributed to the commercial nature of agriculture in and around cities. Men and women may differ strongly in their preferences and priorities related to their main roles and responsibilities, for example regarding production goals (enough food for consumption versus surplus products to sell at the market), preferred location of plots (women with young children often prefer to work close to the home), preferred mode of production (single versus multiple cropping) etc. (Wilbers et al., 2004). Men and women also have different responsibilities related to production and reproduction, depending on socio-economic and cultural circumstances. This division of labour relates to the types of tasks assigned associated with certain crops (eg. cash crops or larger livestock versus food crops and smaller animals) and objective of cultivation (eg. subsistence versus income generation). Beyond actual cultivation, men and women farmers participate in governance, local politics, and community groups, linking social activism with food security issues (Wilbers et al., 2004).

Gender dynamics also influence access and control over productive resources (including land, credit, labour and information), as well as access to and control over the benefits of production. While both women and men face constraints regarding access to land, women are often further disadvantaged because they traditionally have less access to and control over land than men. Men tend to have the first choice of any available vacant plots of land, which leaves women with low-quality, less secure plots of land, or plots that are located far from their homes. Much time and effort must then be devoted to travel, which proves to be a significant constraint for women, especially the elderly or those with young children. Farming in remote and insecure places can also increase the risk for women farmers (Wilbers, et al. 2004). Thus, it is important to acknowledge that increasing access to land as such may not solve the problem of inequitable access to urban land between women and men (Hovorka 1998). There is often also inequitable access between men and women regarding other agricultural inputs, labour, and information. Men and women differ with regard to their knowledge of, for example, the husbandry of certain crops and animals, the application of certain cultural practices and the use of certain technologies. Limited information on and exposure to the use of modern inputs and technologies may also be the result of limited access to training courses offered by institutions or NGOs. The fact that women are less likely to benefit from research or extension services that fail to consider gender-specific differences regarding methods of plant production, crop species and use of compost, manure and fertiliser also plays an important role (Wilbers 2004).

Alice Hovorka

Both men and women view the sector as a means of economic or socio-cultural empowerment

Gendered access and control over productive resources are rooted in socio-economic conditions and legal arrangements whereby women are often disadvantaged through institutionalised gender inequities related to access to capital, education, and off-farm employment opportunities, as well as laws governing inheritance and land transfer. Moreover, women often have rights to use renewable products (for example, harvesting leaves from trees), while men have rights of consumptive use (harvesting the tree itself). Decision-making patterns are also highly gendered on account of differences in men's and women's ability to exert power and control within the household, community and municipality. Beyond recognising such gendered experiences, access to resources and decision-making capacities, it is important to design an urban agriculture agenda that has gender needs at its core. As urban food markets evolve, women often continue to be disadvantaged.

Considerable research, policy and advocacy initiatives are needed to ensure women are able to compete on an equal basis with men in urban and periurban food markets (Mitullah, 1991, Robertson 1997, Purushothaman et al., 2004). To this end, key elements of a gendered sustainable urban development agenda are outlined in the section below.

Towards Gendered Sustainable Urban Development

As an emerging development strategy, the urban agriculture agenda is well poised to accommodate just and equitable guidelines for addressing the needs and interests of both men and women. But this can happen only when there is clarity about what gender means and how to "do it". As recently noted in the UNDP (2003) report on gender mainstreaming, nowhere is the gap between stated intentions and operational reality as wide as it has been in the promotion of equality between men and women. While organisations and institutions continue to grapple with the incorporation of gender dynamics, the needs and priorities of one half of humankind have yet to make it to the centre of the development agenda. Emerging largely in the 1990s, the Gender in Development (GID) approach aims to challenge the dominant and widely held development directions shaping choices and practices amongst the international community. It largely focuses on the analysis of different roles of men and women, and their respective access to and control over resources and decision-making (UNDP, 2003). This approach is broader than the original focus on Women in Development (WID) that tended to isolate women's interests without considering the power relations and dynamics between men and women in the development process. Beyond embracing this approach, achieving a gendered sustainable urban development agenda requires a concerted effort around five elements of mainstreaming, namely conceptual clarity, identifying practical and strategic needs, political will and commitment, capacity building and resource allocation, and scientific research.

Gunther Merzthal

Women are forced to take up a productive role

The first element of a gendered sustainable urban development agenda is conceptual clarity. It is difficult to find a group of development practitioners other than "gender experts" with a shared understanding of what gender mainstreaming actually is and how it is done (UNDP, 2003). Adding to the confusion is the over- or mis-use of the term "gender" in policy documents and strategic frameworks, which muddles the conceptualisation of such an approach. Gender can be defined as the socio-cultural construction of roles and relationships between men and women. Gender analysis involves the examination of their roles, responsibilities and social status in relation to local cultural perceptions of masculinity and femininity that delineate access to opportunities and resources in a particular context (Hovorka, 1998). Gender mainstreaming means identifying gaps via gender-disaggregated data, developing strategies to close those gaps, putting resources into implementing the strategies, monitoring the implementation, and holding individuals and institutions accountable for the results (UNDP 2003). A gendered sustainable urban development agenda recognises that concrete, positive structural change can emerge only if both men and women make concerted efforts to addressing gender inequities. Unfortunately, the concept of gender has come to be widely simplified to be just another word for women, instead of denoting a human rights based approach.

The second element is the clear articulation of practical and strategic needs of men and women that are appropriate to the context at hand. According to Moser (1989), practical needs are "immediate needs related to the inadequacy of [people's] living conditions, such as the supply of food, water, health care and employment". Satisfying them implies no change in gender relations. Strategic needs "are related to the division of labour, power and control by the genders, and can include issues such as legal rights, eradication of household violence, equal wages". Satisfying them helps men and women achieve greater equality and bring about shifts in existing roles. Practical and strategic needs are interrelated, and involvement in urban agriculture can contribute to satisfying both (Hovorka forthcoming, Wilbers *et al*. 2004). Ideally, planning around urban agriculture should address gender issues as well as women's issues in two ways: first, by helping women to cope with their immediate, and often marginalised, circumstances; and second, by helping women achieve positive, structural change in their lives (Hovorka forthcoming). Identifying the type and scale of intervention (be it through programmes, planning or policies) should rely on a solid understanding of the local context and structural factors that delineate opportunities and constraints for individual producers. Short-term and localised interventions may involve small lines-of-credit or extension services, while longer-term and institutional interventions may require more substantial changes to legal frameworks, land allocations and social norms that often marginalise women relative to men (Hovorka forthcoming).

The third element is political will and commitment amongst key stakeholders at all scales. Concepts and methods become meaningful and applicable only if and when the organisations and institutions promoting them actually support them. This means that gender mainstreaming must be a stated organisational goal all the way through the system. Leadership is key: without senior management support, it is difficult (even impossible) to achieve results (UNDP, 2003). Gender mainstreaming requires a concerted effort amongst researchers, practitioners and decision makers in order to strengthen linkages between research, programming and policy/planning initiatives around urban agriculture. Women's groups and their collective practices related to urban farming could be promoted and involved in the community processes so that the women will be recognised as social and political actors, thus converting urban farming into a citizen's concern.


Gunther Merzthal

Many tasks outside the farm are performed by the women

The fourth element is capacity building and resources allocation to achieve gender mainstreaming and successful monitoring and evaluation. Logistical support and material requirements are essential for gender mainstreaming at municipal, regional, national and international levels. In general, building capacity for gender mainstreaming has emerged as a particularly elusive goal in development cooperation, and initiatives have constantly faced a lack of necessary skills, inadequate resources, and weak institutions. Training is fairly general for civil servants – participants are rarely asked to look beyond the difference between sex and gender, the differing roles of (wo)men, and their own prejudices and stereotyping practices. Even those who emerge from such training convinced and committed after are unsure how to translate their convictions into daily work, particularly in the more specialised sectors that seem remote from gender concerns (UNDP, 2003). Gender mainstreaming demands expertise, which in turn requires resources, and until organisations back up their gender promises with money, inaction will continue. Such operational challenges often stem from the fact that, as the quintessential "cross-cutting" issue in development, gender is rendered institutionally homeless. By making gender everybody's job, it can easily become nobody's job. Budget implications are significant, given that cross-cutting issues seldom sit atop dedicated pots of money for hiring staff and experts, and agenda pushing is easier done if money is attached to political will (UNDP, 2003). There is also need to develop ways to measure success in mainstreaming. At the moment, it is too easy to sprinkle the necessary references to women, gender, participation and equality through documents and then claim to have "done gender mainstreaming". The shift to results-based management provides way to address this problem (UNDP, 2003).

The fifth element is continued access to rigorous and insightful scientific research on gender dynamics. Creating a foundation for gender mainstreaming around urban agriculture requires a solid research base, which explores conceptual issues and provides empirical evidence of men and women's differential and often inequitable experiences with food cultivation and livestock rearing in different cities around the world. Research can reveal these differences, identify the mechanisms that often keep women in a disadvantaged position, and establish the significance of urban farming in people's everyday lives. Gender research, as detailed in Box 5.1, provides an entry point into such investigations, including gender-disaggregated data collection, interpretation and analysis of results, and allows researchers to uncover the "underlying power relations and structures that create imbalances and inequities between men and women" (Hovorka, 2001). An action-oriented research agenda that incorporates continuous interaction with and feedback to communities is essential in this regard. Theoretical and empirical research on gender and urban agriculture provide a springboard for programming, planning and policy initiatives, whereby researchers can identify the practical and strategic needs of men and women in order to formulate action plans to support urban agriculture.

Conclusion: Gendered Urban Agriculture Strategies

There are numerous examples of urban agriculture strategies that address and incorporate, to a greater or lesser degree, the above-detailed elements of a gendered sustainable urban development agenda (see for example, cases in the *Urban Agriculture Magazine* No. 6 and No. 12). The three case studies featured here include Peru's Resources for Development Association, which promotes communal gardens through a GID approach; India's collaborative government-NGO effort, which promotes increased market access together with increased entrepreneurial skills development, and Senegal's GIE Bokk Jon cooperative movement, which promotes community-based integrated food production systems. Each demonstrates ways in which gender issues are being incorporated into urban agriculture projects.


Gunther Merzthal

Marketing of produce at a farmer's market in Rosario

The case studies highlight the fact that gender is conceptualised as primarily "women-focused", bringing attention to women's disadvantaged circumstances compared to their male counterparts. The Peruvian case goes beyond this conceptual focus to illustrate the change in gender relations and redistribution of power between men and women that comes about as a result of supporting and encouraging urban agriculture projects. The distinction between practical and strategic gender needs is central to all of the cases, best illustrated in the Senegalese case where local cooperatives are improving women's immediate circumstances, as well as facilitating empowerment and self-fulfilment in the women themselves, and have been paired with a recently passed law addressing equal access to land. This relates directly to the element of political will and commitment so essential in establishing a gendered sustainable urban development agenda. Both the Sengalese Government and local authorities in Peru are lending legitimacy to urban farming activities, thus facilitating greater success of local initiatives. Capacity building and resource provision is a key element of all of the case studies, largely focused on the local community level, whereby women's empowerment is seen as a two-tiered strategy comprised of both skills training and increased access to capital and infrastructure. Finally, both the Peruvian and Indian cases illustrate the importance of research in documenting and understanding local gender circumstances and dynamics prior to establishing a plan for action.

Box 5.1 *Gender Research*

The incorporation of a gender framework into urban agriculture research involves a two-tiered process of gender-disaggregated data collection, as well as gender interpretation and analysis.

First, researchers must collect information on the different experiences, needs, interests, and access to opportunities and resources of both men and women so as to establish an accurate picture of the local context. This stage of the research aims to answer the questions who, what, when, where, and how urban agriculture systems function with regard to gender dynamics.

Second, researchers must ask why such gender dynamics occur. It is not enough to document differences; rather, researchers must probe deeper and examine the factors that create and influence differential opportunities and constraints for men and women at the local, regional and global level.

It is important to make clear the need for a two-tiered gender framework. While literature on urban agriculture contributes to the understanding of women's roles and responsibilities in this regard, it seldom illuminates or questions the form, significance and impact of gender dynamics. Women farmers are often dealt with in isolation from other research components, resulting in a single sentence or paragraph documenting data on, for example, women's relative lack of socio-economic status compared to men's. Researchers seldom go beyond collecting gender-disaggregated data. Hence, there is a tendency to overlook the underlying power relations and structures that create imbalances and inequities between men and women. It is important to remember that gender does not refer to women alone; rather, it refers to the dynamics between men and women. Researchers who go beyond simply gender-disaggregated data collection to explore gender dynamics in depth have been able to provide some of the most comprehensive, interesting and thought-provoking pieces on urban agriculture (eg. Freidburg 1997, Lee-Smith & Memon, 1993; Maxwell, 1994; Mbiba, 1995; Mianda, 1996; Mudimu, 1996; Rakodi, 1991).

Finally, a gender framework must highlight the issue of scale to unearth the complex linkages involved in understanding gender dynamics. Not only is it essential to analyse intra-household relations, it is also important to explore larger social, economic, political, organisational, legal and ideological structures that shape and reinforce gender differences and inequalities. Rather than considering a particular scale (eg. micro, meso or macro) in isolation, the application of gender analysis leads to the fundamental examination of social structures and institutions that create specific power dynamics at the local level (Rathgeber, 1990). Research may focus, for example, on the gendered effects of urban policy, macro-economics or cultural traditions on the organisation and functioning of local urban farming systems. In turn, localised gender relations can influence structures and processes at the meso and macro scale.

Source: adapted from Hovorka (2001).

It is important to recognise that urban agriculture projects and related policies can have differential impacts on men and women, depending on the degree to which gender has been taken into account during design and implementation. It is also necessary to recognise gendered structural inequities, which manifest themselves in urban agriculture dynamics and reinforce social exclusion, particularly of women.

The list of problems in mainstreaming, understanding and recognising gender dynamics is extensive, ranging from logistical issues associated with gender analysis capacity and allocation of sufficient resources, to more ideological constraints, including strong political commitment, explicit targeting goals for mainstream areas, and development of accountability mechanisms (UNDP, 2003). A significant challenge to a gendered sustainable urban development agenda lies in recognising the ideological barrier in gender mainstreaming that may be summarised in the differences between integrationist and transformative approaches. Many development agencies have emphasised efficiency and opted for the more politically acceptable integrationist approach, seeking to bring women and gender concerns into existing policies and programmes and focusing on adopting existing institutional procedures. But the results of this integrationist approach have yet to transform the mainstream or redefine men's and women's positions within it. These efforts have fallen short of addressing the fundamental legal, economic, political, and social factors that underlie gender differences and inequalities.

A transformative approach to gender in development addresses the issue of power head-on, whereby ending women's subordination is viewed as more than a matter of reallocating economic resources but also involves redistributing power. This approach is fundamentally and explicitly rooted in the protection and promotion of rights, equality and social inclusion. The three cases highlighted in this chapter demonstrate the positive pathway on which a gendered agenda may proceed through support and encouragement of farming in the cities. Ultimately, gender mainstreaming around urban agriculture programming, planning and policy requires having emancipation (or transformation) as an inherent goal.

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India's Collaborative Market Access Initiative

Sangeetha Purushothaman
M.S. Subhas
Mitali Nagrecha

In the periurban interface, immense changes in livelihoods and land use occur. Expansion of cities led by globalisation and privatisation poses risks for existing livelihoods as well as opportunities for new livelihoods that make use of urban employment and markets. In a participatory planning initiative undertaken in 2000 with the twin goals of natural resource management and livelihood enhancement in mind, communities in six villages in the periurban interface of Hubli-Dharwad, India, drew up action plans. One finding was that that none of the plans or strategies of the government and NGOs really worked for the poor (Purushothaman & Purohit, 2002). Separate meetings with landless men and women confirmed this gap in the action plans. Landless women were more tied to the villages on account of their reproductive responsibilities and fewer acceptable options for mobility compared to landless men, who have more mobility.

This initiative was followed by meetings with poor women's *sanghas* (groups) to plan more appropriate strategies. These meetings revealed that previous income-generation efforts failed because markets have changed and products made by the women's groups were now obsolete. Unfortunately for potters, plastic pots had flooded the market, and for basket weavers rubber baskets now had replaced bamboo-woven baskets, and so on. Even those who produced food products, such as pickles, were disadvantaged by companies that produced pickles or other products at much lower rates and in more attractive packaging and that used advertising and brand names to corner the market successfully. To create new options for the poor to access markets, the government and NGOs started several initiatives, two of which are examined below.

Sangeetha Purushothaman

Peri-urban women producers sell their produce in an urban market in Hubli-Dharwad

The Hardware: The Farmers' Market

A *raythere santhe* or farmers' market was recently initiated by local government in Karnataka based on the success of similar initiatives in Punjab (Apni Mandi), Andhra Pradesh and Tamilnadu. The farmers' market is conceived of as a forum for farmers to sell their produce directly to the consumer without middlemen. The local government in Hubli-Dharwad wanted a case study conducted to understand the barriers to success faced by the *rayethra santha*, since the state government intended to upscale this initiative state-wide to all districts in Karnataka. Thus a rapid appraisal was conducted in November 2003, including interviews with farmers who had been issued identity cards to use the *raythere santhe* in Hubli Dharwad and Bangalore.

For participating periurban farmers, there are clear advantages, like a market space, a clean environment and a fair rate, as prices are regulated to be "reasonable". However, there are a number of points to improve upon. In the Hubli market, only 20 of the 80 booths were occupied on average. There were enough customers but farmers still sold most of their produce in the mornings to middlemen. In regular markets, farmers only spend their mornings selling to middlemen (most farmers need to get back to work on their farms). Barriers included inadequate facilities in terms of washroom and childcare facilities and inadequate bus services to the farmers' market, which meant that farmers were unable to transport goods.

The *raythere santhe* is supposed to be attractive to customers because rates are lower than those at the regular market. However, it was found that prices were not consistently lower. Every morning officials of the Agricultural Produce Marketing Committee (APMC), together with farmers, should set rates between the wholesale and retail rates, so as to benefit the consumer but simultaneously make the market unattractive to middlemen. Another finding was that farmers were bringing large quantities of one product, which could not be sold retail, and were thus forced to sell to middlemen. Farmers should be encouraged to diversify production so that they can sell smaller quantities of different products consistently at the *raythere santhe* at this higher rate, which would simultaneously provide the variety demanded by urban consumers. Finally, not all farmers can engage in direct marketing if it means having to sit at the market from morning to evening. In Madurai, for example, this is not the case. The market starts at 6 or 7 a.m. and all produce is sold by noon. Farmers might have more incentive to sit at the market or have a family member do so if there are more consumers and if they earned a greater profit.

Sangeetha Purushothaman

Three landless periurban women from Mugad being trained in MOVE to become entrepreneurs

The Software: Capacity Development to Access Markets

In conjunction with the above local government strategy, a new initiative entitled MOVE (Market Oriented Value Enhancement), funded by the Natural Resources Systems Programme of DFID (UK Directorate for International Development), brings together marketing management experts and community-based organisations in Dharwad. Under MOVE, a small group of poor landless periurban women were selected and are being trained in the basics of setting up and running small and micro enterprises to make themselves self-reliant in the free market economy. These women are not fully motivated, and depend on subsidies and doles offered by the government and other agencies; on the other hand, they are unable to face hardships and problems. The project team has attempted to evolve a detailed methodology of converting these zero-level potential entrepreneurs into full-blown entrepreneurs by increasing the motivational levels and providing them with skills to understand the market.

Motivational training is done by the NGOs and is something that only NGOs can do. What motivates a woman may be different from what motivates a the traditional male entrepreneur. Women want to be seen as being able to contribute towards household decision-making, especially financial decision-making, and as leaders who can make decisions in their communities. Mobilisation of women into *sanghas* is a first step. These women then need to be taught the value of sharing risks and labour, and that unity among women contributes towards building and sustaining communities.

The *training on markets* is intended to help these women, in part, understand market dynamics in rural, periurban and urban areas, distinguish between qualities of products, enhance their marketing strategies, negotiate with retailers and form direct relationships with consumers.

MOVE started only in 2004 and it will take more time before it can fully materialise. Early results show that the participating women became more conscious of prices after visiting different markets where they learned how to negotiate prices. They have also become more confident, have a better understanding of value addition to products (roasting, sprouting of cereals, packaging, etc.) and, with some encouragement, they also came up with new product ideas. Finally, the women and the NGOs working with them now understand the difference between group-based product identification and market-oriented product identification.

New Hardware and Software Needed

Building poor women's capacities to understand markets, mobilising them into groups to deal more effectively with other actors in the market, creating innovative financial instruments, and providing a marketing infrastructure are the most important components needed to facilitate access to markets for women. Government initiatives typically only provide the "hardware", without providing any training to build marketing skills of those using the *raythere santhe*. While taking the initiative to provide infrastructure, transportation and other facilities, the government activities need to be more tailored to the poor, particularly to women. Government rural credit provision programmes often come to a grinding halt in the periurban areas, the very space where credit is most needed. Access to formal banks and other financial institutions for the poor is declining in the face of the rapid retreat of government programmes, as urbanisation spreads and urban municipalities expand.

In contrast, NGO capacity-building initiatives provide the necessary "software" but often not the hardware. They build people's capacities to understand the market but do not provide the necessary infrastructure or credit. In fact, credit instruments promoted within community-based organisations can be detrimental to production, while extremely beneficial for meeting consumption needs. One major contribution of NGOs, however, is the mobilisation of women producers, which is the building of social capital. There are several successful examples of how women, when mobilised, can negotiate more effectively within the market. It is the combination of the software and hardware that will actually make the best use of the opportunities that the periurban interface and the new markets offer qualities of products, enhance their marketing strategies, negotiate with retailers and form direct relationships with consumers.

Note

[1]This article incorporates material from the paper "Women Feeding Cities: Re-focusing the Research Agenda" by Diana Lee-Smith, presented as the Keynote Address at a meeting organized by Urban Harvest and RUAF on Gender and Urban Agriculture in Accra, Ghana, 20–23 September 2004.

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Peru's Resources for Development Association

Marta de Olarte

Urban agriculture has steadily increased in the past few decades in metropolitan Lima, largely brought in by rural migrants. These new urban dwellers have maintained their agricultural ways, planting crops and raising domestic animals on a small scale on their home plots. This context led to the Resources for Development Association (REDE) to promote "communal gardens" in the southern cone of Lima beginning in 1994, as a way to fight hunger and malnutrition. REDE observed that the active intervention of women's organisations in the communal garden projects empowered these women. They participate at different levels in public life, and this results in an increase in consciousness, well-being and available educational opportunities. REDE works with a GID focus in urban agriculture. The roles and the needs of men and women are analysed in order to empower and improve their position as part of the betterment and transformation of society as a whole.

REDE

Training of Trainers in Urban Agriculture, AUSAN project

The initiative of the communal gardens was very well received by the population, which is predominantly made up of women who are of child-bearing age and members of large families. As the providers of food for their families, they see urban agriculture as an answer to their practical needs and as a way to fulfil their gender role, e.g. producing vegetables and preparing the daily family diet.

A team of agricultural promoters was selected and trained to implement the REDE project, but also to ensure a multiplier effect through other women's groups in Lima and the provinces. Thes promoters later became the trainers themselves. The invitation to become promoters was extended to men and women, but it was the women who were the most interested in this type of work. It should be noted here that there is a cultural acceptance by men of the idea that women and children carry out small-scale gardening and remain in their homes. The garden became an empowering place for the women: it improved their self-assurance and self-esteem, heightened their expectations of life, and improved the division of labour with their spouses. At the beginning, some men protested when their wives attended the training or provided technical assistance in school or community gardens. This changed as these men witnessed the progress and the perseverance of the women in the gardens. The public recognition given by the authorities and the community to the work of this group of women provided a lot of weight in the process of legitimisation.

Subsequently, after this recognition, husbands and sons started offering their moral and physical support to the women's groups by helping in preparing the land, collecting manure and irrigating the crops. The families began to appreciate the project as theirs, and to validate it from inside the home. There have been cases in which the husbands or sons replaced the women in the gardens when they had other things to do, like attend meetings of their organisations (eg. Clubs of Mothers, School Committees, Community Kitchens).

This experience motivated REDE to initiative a new stage of work at the end of 2002. With the help of German Agro Action, REDE launched a new initiative on urban agriculture that focuses on women with little children (under the age of five years). This project, which is in its initial stages, promotes the strengthening of women's roles.

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Senegal's Cooperative Movement

Nathan McClintock

In Senegal, urban agriculture has grown rapidly in response to the fragile nature of urban food security and to meet the market needs of the growing urban population. Inadequate access to land, precarious land tenure, and insufficient water and manure make urban farming increasingly difficult. These constraints are often felt more acutely by women farmers whose access to land, manure, and water is even more limited than that of men. Over the last few decades, the creation of *groupements d'interêt économique* (GIEs), or village and neighbourhood cooperatives, as well as the creation of *groupements féminins*, women's groups, has been a vital source of empowerment for women farmers in Senegal, providing them with access to capital and training. In the past several years, many women's groups – urban and rural, official and unofficial alike – have embarked on successful agricultural endeavours, providing participants with income and incentives to stay in their communities of origin.

Two kilometres south of Thiès, Senegal's second largest city, lies Touba Peycouck[1], a village of 2,000 people. The activities of the GIE Bokk Jom of this village provide an inspiring example of grassroots community development. In the integrated system of animal husbandry, agroforestry, gardening, and field crops, women play the major role in maintaining the soil's fertility through their composting activities. Of Bokk Jom's 72 members, 42 are women. Several administrative positions are held by women, including Assistant Secretary General and Treasurer. A revolving micro-credit programme provides women members with 6-month, 25,000 FCFA loans at 7.5 percent interest. Recipients have used these loans for various business ventures and none has defaulted on payment since the programme began. The incomes of members are higher than those in the rest of the village, and their access to training and status in the community has improved. When asked what women contributed to Bokk Jom[3], several male members said the success of the ongoing composting and agroforestry projects is due to the high level of participation of the women.

Nathan C. McClintock

Bokk jom members in one of the experimental gardens

Soon after its creation in 1990, Bokk Jom opened a small grocery shop, supported the village elementary school, and later opened a public telephone booth and a small library. They also built a wood-fired oven for bread baking. In the mid-1990s they raised 500,000 FCFA[2] and received a 5.7 million F CFA grant from the United Nations Development Program (UNDP) to embark on an ambitious development project integrating animal husbandry, agroforestry and gardening. The Rodale Institute, an American NGO, provided training in gardening, agroforestry and composting techniques. Bokk Jom started a tree nursery and launched a large-scale reforestation campaign. The group purchased four local milk cows and had them artificially inseminated in order to produce offspring with higher milk production. They then constructed a chicken coop and started to produce poultry, earning more than half a million F CFA in profit per year. With additional technical training from Rodale, Bokk Jom constructed several large composting pits to transform the cow manure and poultry litter into quality fertiliser. The compost is used for tree, garden and field-crop production.

After the fertilisation needs of the group's tree nursery are met, members have the right to take compost produced in the group pits and use it on their personal plots. In addition to this compost, many women have started their own compost pits within their family compounds, which they fill with kitchen scraps, cooking ashes and manure from tethered livestock. Most women in the group own their own animals, on average three to five goats or sheep per person. The use of compost has spread rapidly throughout the village and into neighbouring villages. Ninety percent of produce is sold, usually to other village women who buy in bulk to sell at the markets in Thiès and nearby Rufisque and Bambey. Two-thirds of the remaining 10 percent is given away as gifts, and only a third kept for family consumption. While whatever revenue a woman earns from her gardening is her own, a large portion of it goes to purchasing food for the family.

Nathan C. McClintock

Bokk Jom members in their office

The shortage of land in Touba Peycouck is a primary constraint. The *périmetre communale*, or village garden area, is divided into a hundred 20x20-metre (400 m^2) plots. Based on selection criteria that included salary and available labour, village officials allocated plots to the *chefs de carrés*, male heads of household. Women have access to garden plots only through their husbands or by renting plots for 25,000 F CFA for the October–June gardening season. Currently, only a third of the women in Bokk Jom maintain their own plots, whereas all of the group's men are active in gardening. Women in one focus group complained that they had plenty of compost but no plot on which to use it. In addition, gardeners must pay 4,000 F CFA per month for water. These overhead expenses, as well as start-up costs of seed and equipment, discourage many women from gardening. Others abandon their plots during the gardening season if they are unable to make a profit, and turn to pretty trade in order to earn enough to cover expenses the following year.

As elsewhere in West Africa, women's role as urban farmers is limited by these constraints, leaving the majority of production in the hands of men. Nevertheless, cooperatives such as Bokk Jom improve women's access to land and infrastructure by offering credit at reasonable interest rates, as well as by providing them with opportunities to pool resources. Most important, perhaps, and most difficult to quantify is the sense of empowerment and pride that membership elicits from female members. While Bokk Jom's primary goal is not to improve the livelihoods of Touba Peycouck's women, its success has directly benefited its female members by providing them with a solid organisational foundation and forum for cooperation. Nevertheless, patriarchal traditions within the community on the whole ultimately define the extent of women's participation in urban agriculture. Gender-specific initiatives to provide assistance to cooperatives such as Bokk Jom may ultimately be necessary to overcome these obstacles.

In a final brainstorming session[3], the Bokk Jom members came up with the following policy recommendations:

- Guarantee women equal access to land
- Provide incentives for sustainable agricultural production
- Promote womens' groups and facilitate access to funding and credit
- Expand technical training opportunities for women
- Improve public health awareness and infrastructure.

A recently passed law (*Loi d'orientation agricole*) addresses the first concern by guaranteeing equal access to land. The true challenge will be to enforce it. Some of the remaining recommendations may seem impossible to instate on a government level because of cuts to public programmes in the name of "Structural Adjustment" and because of "free trade" regulations prohibiting agricultural subsidies. However, they provide a useful and relevant framework for NGOs and aid agencies working both with policymakers and directly with local people. Groups like Bokk Jom have been successful in addressing some of the very real constraints facing the farmers of Touba Peycouck and women engaged in urban agriculture throughout the developing world.

Notes

[1] Several villagers, exhausted by their financial burden, formed the village GIE, or Bokk Jom, in 1990 in an effort to improve their opportunities. In Wolof, *bokk jom* means to unite for a common cause.

[2] The F CFA, or West African Franc, is fixed at an exchange rate of 656 F CFA to 1 Euro.

[3] Five focus groups consisting of 4–8 people each held meetings in September and October 2003 in Touba Peycouck during the author's three-month internship at the Rodale Institute in Thiès. Further data come from Akakpo and Ki (2000), who surveyed 100 villagers to evaluate the impact of Bokk Jom.

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Akakpo, K., and J.B. Ki. 2000. Evaluation du projet plurifonctionnel du GIE 'Bokk Jom' de Touba Peycouck. Rapport de Stage, Ecole National d'Economie Appliquée, Dakar.

Resources

Gender Mainstreaming in Poverty Eradication and the Millennium Development Goals. a handbook for policy-makers and other stakeholders
Naila Kabeer Commonwealth Secretariat/IDRC/CIDA 2003; ISBN 1-55250-067-5; 240 pp.
In this book, Naila Kabeer brings together a diverse set of arguments, findings, and lessons from the development literature that help to explain why gender equality merits specific attention from policymakers, practitioners, researchers, and other stakeholders committed to the pursuit of pro-poor and human-centred development. This book explores the issue of gender inequality through the lens of the Millennium Development Goals, particularly the first one of halving world poverty by 2015.

Gender resources for urban agriculture research: Methodology, Directory & Annotated Bibliography
Hovorka, A. (1998). In: Cities Feeding People Series, Report 26. ;Ottawa: IDRC3
Although there is a growing interest in the factor gender in development research, there is also a general lack of understanding of how this type of analysis can be applied. Purpose of the underlying publication is to provide researchers with simple and systematic methodological tools for practical application of gender analysis within urban agriculture. It has been developed primarily for the Cities Feeding People team members, but can be applied by anyone doing a similar type of research.

RUAF Working papers on Gender and Urban Agriculture
1. Gender in Urban Agriculture, Wilbers, J. (2004) unpublished
This discussion paper was prepared as a start up of the discussions in the RUAF advisory group on gender and urban agriculture, as a first step in the preparation of an expert consultation and as an input for the RUAF-IDRC Workshop on Gender in Urban Agriculture, held in Johannesburg, South Africa in July 2003.

2. The integration of Gender in the RUAF programme, De Zeeuw, H. & J. Wilbers (2004) unpublished
This second discussion paper was developed to further strengthen the RUAF strategies regarding mainstreaming gender in urban agriculture as well as to begin the development of guidelines regarding the integration of gender in research, policies and action planning on urban agriculture.

3. PRA tools for studying UA and gender, compiled by De Zeeuw, H. & J. Wilbers (2004) unpublished
This document was prepared to facilitate the formulation of the gender case studies to be undertaken by the Regional RUAF centres in 2004 as a training exercise and an input to the gender expert consultation 'Women Feeding Cities', organised jointly by RUAF and Urban Harvest in September 2004 in Accra, Ghana.

These papers have been discussed among the RUAF partners and the RUAF Gender Advisory Group, and are available at www.ruaf.org.

Mind the Gap, Mainstreaming Gender and Participation in Development.
Nazneen Kanji. 2003. IIED, IDS. UK. ISBN 1 84369 466 2
This publication, no. 4 in the series on institutionalising participation, highlights lessons from gender mainstreaming work for those who seek to institutionalise participation. After a discussion on (changes over time of) conceptual frameworks, strategies, and the suggestion that there has been a shift from participation to governance (along with the shift from women in development to gender in development), the tensions between gender mainstreaming and participatory development are explored. Suggestions are made to overcome this tension.

Questions of Difference: PRA, Gender and Environment, A Training Video.
Irene Guijt. IIED. ISBN: in English: 1 904035 83 3 (also available in French and Portuguese).
This two-hour video with provoking images can be used to stimulate discussion and to lead into class-based exercises. A summary is given of the key elements for using PRA to understand gender and environment. The video is structured in thematic segments of 2-14 minutes. In that way users can select those of interest or for specific training. The three case studies show workshop participants using PRA methods to explore gender and the environment.

www.fao.org/gender
This is a Gender and Food Security site of the Food and Agriculture Organization of the United Nations. It contains articles on and a thorough set of statistics and other information on projects and programmes is available.

www.aviva.org/
Aviva is a FREE 'Webzine' (internet magazine), which provides a free listing service for women everywhere who would like to come in contact with each other, and it acts as web site 'host' to Women's Groups and Services globally.

Chapter 6

Urban Agriculture and the Building of Communities

The worldwide practice of urban agriculture has shown itself to be an often-successful model for the inclusion of different urban sub-communities into an intentional social organisation typically focused on producing the necessary resource of food. But the general value of urban agriculture as a means of achieving several other community objectives – in building community capital – is of equal significance. This chapter suggests how community capital is composed of seven dimensions, each of which is commonly addressed in some way through the practice of urban agriculture. The multi-faceted character of successful community-based urban agriculture examples is based upon the addressing of one or more of these seven dimensions to create a place-based form of grassroots community development, while also involving representatives of often-marginalised subgroups, such as women, youth and the poor.

Urban Agriculture and the Building of Communities

Jac Smit
Martin Bailkey

Introduction

Cities in the 21st century contain many different "communities". One can distinguish between communities of interest (belief, cultural background, football, golf, learning), communities of circumstance (race and ethnicity, disabilities, prisons, orphanages), and communities of place (cities, villages, gated communities, refugee camps, Wall Street). Members of each of these communities recognise the commonalities that link them as a community, but do not see themselves as separate from the rest of urban society.

Martin Bailkey

Kenya Green Towns extension agent Elijah Githee instructs members of the Together Home Craft Self Help Group on planting lettuce in plastic containers, Nakuru, Kenya.

Examples of urban agriculture worldwide, including many described in this book, display situations where the practice of city farming accommodates often marginalised subgroups. Urban farming repeatedly allows for the inclusion of women, children, the poor, the homeless and the elderly into constructive food production activities (see chapter 5). Thus urban agriculture, in a manner consistent with the practice of conventional community (social and economic) development, can be a constructive contributor to city neighbourhoods, and the social networks of entire cities (see also the discussion in chapter 1 on social impacts). This goal is articulated in the mission statement of the American Community Gardening Association, a key non-government supporter of city farming in the US and Canada:

> *The Association recognises that community gardening improves the quality of life for people by providing a catalyst for neighbourhood and community development, stimulating social interaction, encouraging self-reliance, beautifying neighbourhoods, producing nutritious food, reducing family food budgets, conserving resources and creating opportunities for recreation, exercise, therapy and education.* (ACGA, 2006)

Evidence for the growing of food within the social structures of cities can be found throughout recorded history. As societies and cities have changed, so too has the role of urban farming and food production – particularly when much of the world's population, especially those in developed nations, participates in an efficient global system of food production and distribution. In richer countries, urban and peri-urban food production, whether through community gardens in the US or allotment gardens in Europe, is viewed primarily as a desirable addition to the global corporate food network. In developing nations urban agriculture maintains its importance as a source of meat, fruit and vegetables for those lacking the access and income to participate in the global food economy.

Whether practiced in rich or poor nations, certain forms of urban agriculture display a social organisation that focuses on creating stronger urban communities. These activities reflect a grassroots understanding of local needs and skills, and link this to a complimentary understanding of the multiple functions of urban agriculture in a way that, when successful, grants participants a sense of shared accomplishment in how the methods and results of food production and distribution translate into something more encompassing. We call such activities *community-based urban agriculture* (CBUA), and they are the subjects of this chapter.

The thesis of the chapter is that urban agriculture, as a community-driven and community-managed activity, makes significant direct and indirect contributions to urban residents and urban regions. These contributions are similar to the targeted goals of place-based *community development* as set by national, sub-national and local governments, foundations, and international and local aid agencies. But instead of seeing the members of an urban community as the object of technical development planning, CBUA is a vehicle for a more grassroots form of community development; one that grants its practitioners a sense of inclusion, dignity and accomplishment that might not occur through standard community development practice.

A "community" practicing urban agriculture is often – though not necessarily – a community of place, whose participants share a common home location and create a framework for involvement and inclusion connected to the sharing of this space over time. These actions improve the lives of those in the community both individually and collectively. The concepts underlying CBUA across the world are similar to those of "civic agriculture" in the US, and centre within urban contexts and locations the characteristics of civic agriculture that "reference the emergence and growth of community-based agriculture and food production activities that not only meet consumer demands for fresh, safe and locally produced foods but create jobs, encourage entrepreneurship, and strengthen community identity." (Lyson, 2004).

RUAF

School children learn about growing vegetables and healthy food in Lima, Peru.

Although their differences are not always distinct (and indeed community building requires entrepreneurship), we can distinguish CBUA from other proactive forms of urban agriculture (that also of course may have an important social impact), in particular from: (1) subsistence farming by individuals for themselves and their families; (2) entrepreneurial, market-oriented urban agriculture, often consisting of privately-owned, profit-making businesses; and (3) leisure or recreational gardening (see also chapters 1, 4 and 7 for a discussion on different types of urban agriculture). CBUA, in contrast, is a shared activity focused on intentionally building communities, while producing fresh food, fuel, medicine, ornamentals and handicrafts for local consumption and distribution. At its core – whether through community gardens or allotments, school gardens, cooperative farming on commonly-owned sites, etc. – CBUA provides social interaction, a key attribute of any thriving community. And as food is a basic need of all community members, CBUA provides a centrepiece for shared stakeholder interaction around a necessary activity. This interaction involves mobilisation of the community to establish the objectives and form of the urban agriculture activity, the acquisition of needed resources, the understanding of relevant regulations, and the organisation of the project's execution.

It is important to understand that CBUA is not scale-dependent; in theory, the affected community could be an entire city or a single neighbourhood. In practice, however, CBUA works well when it builds upon the initiator's cognitive understanding of a particular community, whether a prison or a housing estate, to which the project can be tailored and the benefits appropriately directed. And at the larger scale of the city, the aggregation of many CBUA activities can have a significant effect on the total quantity of locally-produced food available, the reuse of municipal waste, and lower living expenditures among the poor.

Cities are complex social, economic and political entities. Thus the ownership and administration of CBUA activities can also be complex when compared to rural agriculture. Examples of this complexity would include self-organised community gardens and gardens supporting community kitchens; food cooperatives and community supported agriculture sites (CSAs); leases based on payment of a share of the crop or of its value; leases to not-for-profit organisations (NGOs and CBOs) with subcontracts to the farmer; company gardens for employees; and perhaps most typical, land use arrangements with outside parties owning the land or controlling it in some other way. Although, in general, CBUA has a permanent social and economic role in modern cities, individual operations are often only temporary occupants of urban sites.

Box 6.1 *Community Supported Agriculture*

A growing number of consumers in the US and elsewhere are forming new communities around food through the mechanism of community supported agriculture (CSA). In the standard CSA model, a farmer sells "shares" to individuals and families who invest in the farm through a single payment at the start of the growing season, then receive a steady supply of seasonal vegetables and other farm products when harvested. In addition to developing a close acquaintance between farmer and consumer (in essence, shareholders take on the farmer's risk), CSAs promote a sense of local community by encouraging shareholders to spend time working on the farm, by making the regular receiving of food an opportunity to meet other shareholders, and by the arrangement of "worker shares" or other subsidy mechanisms to allow poorer residents access to the fresh produce of the farm. In the US, CSAs often involve smaller peri-urban or rural farms close to metropolitan areas, but urban CSA farms also exist (see the Troy Gardens case study below)

The CSA concept originated in Japan in the mid-1960s, was later adopted in Switzerland, the UK, and the rest of Western Europe, and since the mid-1980s has taken hold in North America. There are now over 1,100 CSA farms in the US, concentrated in the Northeast, the upper Midwest and along the Pacific coast. The concept is attractive to more affluent urban consumers who appreciate the direct supply of produce and the "farmer's face on the food" philosophy behind the CSA movement. In the villages and cities of poorer nations the CSA principle of direct delivery from farm to consumer occurs through traditional methods of barter and informal exchange. For example, it is common practice in Latin American cities to swap crops from community gardens to adjacent community kitchens.

CSA operations have evolved into different farmer/consumer linkages, and can creatively incorporate new technologies. In Washington, DC, laptop communication is employed to allow local farmers to receive daily food orders from the chefs of Clyde's, a nine-restaurant corporation in the Washington area, and package the orders for delivery the next day.

Reference: Robyn Van En Center 2006

According to surveys by WHO, FAO and UNICEF, the cost of food to low-income communities in most countries demands one-third to two-thirds of family income. Since food production through urban agriculture takes place within the community, food acquisition need not go through the money or formal economy, and thus can direct scarce individual or family resources toward other needs. The social ties among community members establish efficiencies in the informal economy between CBUA production and distribution through, for example barter. By combining the economic and food security benefits of CBUA, participating individuals and families are able to purchase better health care, housing and education, common goals of community development. These individuals can also improve their standard of living by becoming greater consumers of products from rural areas and the global marketplace. When such improvements in living standards through urban agriculture occur within certain sub-populations, such as the poor and homeless, it supports the argument made by CBUA advocates that outside support for urban agriculture can and should come from the traditional supporters of these sub-populations.

As important as food production and distribution are to the concept of CBUA, the fact that it occurs in a specific location, or *place*, having a physical identity and established social connections, is equally important. The term "place" consolidates in a single location a social component; a built environment of housing, institutions, infrastructure and other land uses; a natural environment of air, water, earth and vegetation; a localised economy; and some form of governmental or institutional structure. It is in terms of "place" that CBUA most is strongly integrated with community development:

> *[Urban development] find[s] realization in a place, in a specific spatial context in which… social processes and institutions intersect with the lives of the city's most vulnerable citizens. And it is in a place that over time… social burdens accumulate. We need to understand those places and make them better for, more than anything else; city-making is place-making (Bender, 2000).*

Box 6.2 *Past examples of community-based urban agriculture*

Agriculture as an important element of daily urban life dates back to the beginnings of urban civilization. Documented records show farming being mapped inside cities on both the Euphrates and the Tigris Rivers 4,000 years ago. More recently, the Holy Roman Emperor Charlemagne issued empire-wide edicts concerning the crops, land management and processing of community agriculture. Maps of medieval cities typically show one-third of the land within fortifications as devoted to agriculture. Benedictine monks are credited with conveying, in practice and writing, Near Eastern and Mediterranean community agriculture methods throughout Europe during and after the Middle Ages. The monastic farms and cloister gardens that adapted ancient methods from Persia, Egypt and Asia were valued for the medicinal plants grown and for providing a strong sense of place to their ecclesiastical communities. They were copied far and wide through the 14th century. From the 15th to the 17th centuries this form of intensive urban food production diminished due to the decline of the monasteries, the arrival of the plague and a widespread degeneration of social order. Perhaps the most famous contemporary case of effective community-based urban farming practice is the seven-year siege of Leiden, Holland during the Thirty Years' War, when the city survived because of its intensive production of crops within city walls during most of each year.

In the late 19th century, and continuing throughout the 20th century, the United States witnessed several periods during which urban food production was established to ease the domestic burdens caused by depression and war (Lawson 2005). Beginning with the "potato patches" initiated by Detroit mayor Hazen Pingree for the benefit of those in his city affected by the 1893 depression, and continuing through the federal War Garden programme during World War I, the work-relief gardens and cooperative farms of the Great Depression of the 1930s, and the "victory gardens" during World War II, federal and local governments created programmes that organised urban communities around food production during troubled times. Later in the century, urban agriculture, in the form of community gardens, was an active component of the grassroots urban movements of the 1960s and 1970s (Warner 1987). Today, this spirit is continued by the American Community Gardening Association (founded in 1978) and its members across the US and Canada, who are at the vanguard of organising urban neighborhoods around the shared social experience of gardening.

Reference: ACGA, 2006; Lawson, 2005; Warner, 1987.

Community Capital: How urban agriculture builds place-based communities

A significant percentage of the 80,000 residents of Nakuru town, located in Kenya's Rift Valley 150 km northwest of Nairobi, have been affected by the HIV/AIDS plague devastating the countries of sub-Saharan Africa. Poverty is evident in the many slum areas of Nakuru and the resources to acquire HIV/AIDS antiretroviral medicines are scarce. Nevertheless, in early 2005, as many as 80 community groups, many organised by women directly affected by HIV/AIDS in some way, have established or are creating, with the help of outside agencies, small bio intensive vegetable gardens to improve their diets and those of their families. These community groups, with names such as the Together Home Craft Self Help Group and the Baraka Kiamunyi Women's Group, are growing food organically on sites as large as 0.6 ha outside Nakuru and as small as 50 m^2 in backyards behind slum homes in town. In these gardens, one finds maize, bananas, passion fruit, beans and other vegetables, grown through the use of compost and manure. Many of these projects are given technical assistance by the Kenya Green Towns Partnership Association together with Urban Harvest in Nairobi. To these poor urban farmers, the nutritional value of the food produced is often as important as the income generated by selling their food to others in town (in the case of the Together Home Craft Group this is combined with the selling of textiles they make and market.)

RUAF

Even when the school has no proper land, children can learn how to grow crops

Similarly, in cities across North America urban NGOs have dedicated many of their projects towards helping poor and at-risk city children and teenagers discover how the life lessons of food production and distribution can help them overcome the negative influences of their home environments. In the Roxbury and Dorchester sections of central Boston, The Food Project enables young people to attain the skills and confidence to become agents of change in their often-troubled neighbourhoods. Each summer for over ten years, 140 young people – both from inner-city Boston and from its affluent suburbs – come together to grow food on urban and suburban sites, donate or sell the food throughout the Boston area, and, most importantly, share their knowledge and pride in their accomplishment with others across the US. The Food Project is at the forefront of developing a new community development model that combines food security actions with youth leadership training using a genuinely modern, even hip-hop, approach.

These examples from Kenya and the US epitomise the way that urban agriculture serves as an intentional vehicle for a special form of place-based community development. The term *intentional* signifies awareness on the part of the initiating group that urban agriculture represents both an end in itself (through the harvesting of nourishing food) and a means by which to strategically achieve additional social and community ends. The women's groups of Nakuru, for example, are largely composed of members of the neighbourhoods where the gardens are located, and view urban agriculture as a means of exercising their sense of self-determination and dignity in the face of hardship. The groups are self-organised, and individually solicit the outside assistance they know they lack to fully achieve their goals. Most importantly, their collective action strengthens their identity as part of a social assemblage, an interacting population in a common location.

This building of community can also be expressed as increasing *community capital*. Seven dimensions comprising community capital have been identified, and their interaction through the production of food and other agricultural products of CBUA will be discussed. Chapter 10 of this book follows a similar and complementary approach by identifying five dimensions of household-based assets found in the literature on rural livelihood strategies (such as Farrington et al., 1999) that are also applicable to poor urban households striving to earn a living. The seven dimensions of community capital introduced in this chapter are adapted from community development and sustainability studies in the US (such as Flora et al., 1999), and aim to more precisely define the particular social outcomes of CBUA.

These dimensions of community capital found within CBUA activities are:

- Human Capital: the health, education, skills of the individuals involved
- Social Capital: the strength of groups, networks, the common vision among their members, and the creation of bridging networks across different groups
- Political Capital: the dynamics of group organisation and leadership, and relations with government and supporting agencies
- Cultural Capital: the values and heritage of the community, and the celebration of such
- Economic Capital: the investments, savings, contracts and grants
- Built Capital: the physical settings – land, housing, other buildings, infrastructure
- Natural Capital: the local air, land, water, biodiversity, scenery

This deconstruction is useful for the analysis of social communities needed for programme and project planning and evaluation, partner identification, leadership training, networking, the acquisition of funding, and political support. It is essential to identify each of these dimensions and bring them into focus for the community and for outsiders in order to conceive, design, and implement community building projects, such as CBUA. Defining the outcomes and results of community development programmes requires establishing indicators for each of these seven dimensions through, for example, surveys and goal identification. The practice of CBUA can and does contribute to all seven essential dimensions of community capital. The following is a brief overview of how each is displayed in CBUA. (Note that several of these dimensions are discussed in greater detail in other chapters of this book.)

Human Capital

The building of human capital within each individual begins with good health that, in turn is built upon good nutrition. At its highest level of community benefit, CBUA reduces a community's level of food insecurity, seen in the lack of access by individuals and families to nutritious food, whether by availability or cost, over the course of a week or month. CBUA makes nutritious food directly available, often through the informal economy, and is a significant source of nutrition and health (Bellows et al., 2004; Patel, 1996). Locally grown and raised vegetables, fruit, herbs, fish, poultry, livestock and dairy products can have one-third to two-thirds more essential micronutrients, minerals and beneficial fats than the same foods that have been stored, packaged, processed for more than a day or two. Better nutrition contributes to community development through improved brain development in the young, more vigorous work days for adults, and, in general, a stronger, healthier population. From a nutrition perspective, one of the most compelling justifications instituting CBUA is to provide sources of fresh vegetables to HIV/AIDS patients receiving antiretroviral drugs through community health providers, especially in situations when poor diets compromise the effectiveness of the medications.

A community-based food system is a secure source of good nutrition, but also strengthens other forms of human capital. For example, many studies examining conditions over the entire 20th century identified school gardens as an excellent educational laboratory – not only for the practical knowledge of how food is cultivated and harvested, and for an awareness of composting and recycling, but for also introducing discipline, organisation and responsibility. As for adults, city farming grants an individual certain practical skills in production, processing and marketing unavailable in other urban industries.

Social Capital

Social capital can be built in place-based communities that often lack social cohesion and shared participation around a common vision. Urban farming within or at the edge of a location brings the members of that location together, most frequently outdoors, and generates interaction. As mentioned earlier, a distinguishing characteristic of successful CBUA is that it generates groups to organise and manage a project(s). Additionally, CBUA often forms bonding and bridging networks that did not exist prior to its initiation. In the US, Aspen Farms, a community garden in primarily African-American West Philadelphia, represents many similar projects in the manner by which its democratically-based organisational structure evolved over time.

> *Aspen Farms looks like a miniature farm, but it is more like a town, with individual plots and common ground… There are meeting places and shared resources, like the greenhouse, the compost pile, the water supply and irrigation system. Originally colonised in 1976… the garden has continued to change, with individual initiatives, negotiations, and group decisions. The gardeners set the rules and elect officers, including a chaplain. (Spirn, 1998)*

Box 6.3 *Supporting HIV-AIDS communities through CBUA*

In August 2005, a sub-Saharan African experts' study visit on the impact of UA on HIV/AIDS in Johannesburg and Cape Town, South Africa was jointly organised by RUAF/ETC, CTA and Abalimi Bezekhaya (see case study). The study found that members of community-based projects were spontaneously providing fresh organic vegetables to HIV/AIDS affected individuals, with the clear knowledge (intuitive and taught) that good nutrition is a vital component of the treatment of chronic illness, including HIV/AIDS. Furthermore, HIV/AIDS-affected individuals who involved themselves in group gardening activities and/or had access to fresh vegetables reported improvements to morale and physical health.

For a full report, contact ruaf@etcnl.nl

Social capital is also built by the contributions CBUA makes to community food security. A sense of community ownership over its local food system leads to a collective sense of empowerment, with those involved thinking better of themselves and their neighbours and being proud of their shared accomplishment. Similarly, an important sub-dimension in the building of social capital through CBUA is the opportunity for women to collectively initiate, structure and implement successful projects tailored to the identified food security needs of their home communities, despite local constraints on resources or control attributable to gender-based discrimination (see Chapter 5).

Box 6.4 *Prison communities and CBUA*

The high rate of criminal incarceration in the US is an issue of national concern, as is the experience of individuals while in prison, and their preparedness for life following release. Several projects have successfully brought urban agriculture and horticulture into city prisons; notably the Cook County Jail in Chicago and the Rikers Island Prisons in New York City. On Rikers Island, a composting facility processes a portion of the city's food wastes, and the compost is delivered to the prison farm where inmates grow and harvest vegetables, while also learning new skills in farming, horticulture and landscaping. In Chicago, 200 inmates at the Cook County Sheriff's Garden farm, a 557 m^2 plot within the county prison, produce fresh vegetables for donation to the homeless and for sale to low-income consumers receiving government food-buying subsidies.

Lowering rates of recidivism is a common goal of prison garden programmes. A pioneering garden project at the San Francisco County Jail led to the 1992 creation of The Garden Project, a local non-profit organisation offering released inmates opportunities to productively use the agricultural and horticultural skills learned while in prison. By planting street trees and growing food for the homeless and elderly, participants in The Garden Project are 25 percent less likely to return to prison than those not involved (See Martin, 1999; Sneed, 2000).

Catherine Sneed, of the County Jail Horticulture Project in San Francisco says "For most prisoners…something happens and something changes, the cycle of growth and renewal allows prisoners to see their own potential for change…" (Sneed, 2000).

Political Capital

Building community through CBUA in most cases requires political action, and identifying and measuring political capital is constructive in guiding these programmes. One measure is programme organisation, and how decisions are made – democratically, autocratically, or some combination of the two. Another measure of political capital is the relationships with those having municipal power in the town or higher government levels. Typically, it is empowering to create active connections to political parties and advocacy groups.

Leadership, and the *voice* that accompanies leadership, is perhaps more essential to the dimension of political capital than to the other dimensions of community capital. Identifying and promoting leadership within a CBUA activity is thus an essential element in developing its associated community; this is a characteristic objective of youth-centred NGOs involved in urban food production, such as Added-Value in the Red Hook neighbourhood of Brooklyn, New York City, which (in a similar manner to The Food Project in Boston) simultaneously addresses both community food insecurity and the need to provide Red Hook youth, and particularly young women, with avenues to develop their leadership capacities. And in democracies where citizens have some influence over public policy, the concept of municipal and regional food policy councils can structure and facilitate the creation of supportive policies by those empowered through their CBUA experiences (Borron, 2003).

Beacon Mbiba

Members of the Woodlands Farm Trust at work in London

Cultural Capital

Cuisine is an important element in building cultural capital through CBUA. Too often the cuisine of urban neighbourhoods is determined by outside food retailers with little thought to any distinct cultural traditions. Alternatively, a community-based food system empowers its members to express and enjoy their cultural cuisine as part of a larger set of cultural traditions. Rural farming is a valued element in the heritage of many cultural groups, and reactivating it in the cities of urbanising countries through the cultivation and processing of traditional crops creates significant ties to past traditions. Celebrations around food production, such as harvest festivals, are common, and are particularly important in connecting youth to their community's traditions.

The future of CBUA in North America is strongly tied to the growth of urban immigrant communities, and in how city farming is employed as a vehicle for assimilation and productive activity. From Afro-Caribbeans in Toronto (Werkele 2001) to Latinos in Los Angeles (Green 2004) immigrants lacking individual access to land are growing ethnic herbs and vegetables, both on highly visible sites and on sites more hidden from view. (As of this writing in March 2006, the 5.7-hectare South Central Farm in Los Angeles, and the organised community of 350 primarily Latino families who have farmed it for 13 years, are threatened with eviction by local authorities. Their mobilisation to save the farm has generated a nation-wide show of support for a notable example of sustainable urban farming, a cultural centre in multi-ethnic Los Angeles, and a symbol of the grassroots renewal of a section of the city devastated by the riots of 1992, the year the farm began.)

Economic Capital

The economic capital of a community is largely built upon the development of human, social, cultural and political capital, in that a healthier, socially and politically stronger community is better positioned to increase its wealth. City farming is a prime poverty-reducing industry. It empowers workers to greater productivity and can represent an expansion of a city's formal and informal economy. (Urban agriculture, whether producing food, fuel or ornamentals, is often the largest industry in the informal local economy.) To a greater extent than rural agriculture, the income generated by urban agriculture turns over within the community and city. It is a stable form of industry, in that the demand for food never fades and the urban producer is closest to and best attuned to market demand. Urban agriculture provides a part-time but stable income source for low and middle-income households engaged in non-secure employment. Savings are increased, particularly for those families that have direct access to local production without having to go through the formal economy.

While urban agriculture can offer certain economic benefits to individual actors operating independently from their communities, successful CBUA activities can channel the economic benefits that accrue to individuals into the larger community. One straightforward example is the successful cooperative vegetable and horticulture operations described in Chapter 7.


Rob Small

SCAGA men now run their own gardens separately (Cape Town, South Africa)

By investigating and implementing various entrepreneurial options CBUA can be an economic activity that facilitates the creation of communally-run economic activities such as farmers' markets, eating places, manufacture of handicrafts, retailing, and export commodities (Feenstra et al. 1999, Kaufman and Bailkey 2000). This is particularly true for activities involving women and the elderly, where established skills can be used, and those involving youth, through which new skills can be taught. Outside contractual relationships for inputs and products are increased through the introduction and expansion of new community businesses. The financing of community endeavours takes on a new dimension - grants and loans can increase in response to evident signs of a self-determined community implementing a sustainable urban development model (see Chapter 4).

Built Capital

The built capital associated with the physical qualities of CBUA is an important, often overlooked, form of community capital that is worth measuring and promoting. Taken in aggregate, the variety of urban agriculture in any one locale – whether in-ground cultivation, balcony gardens outside homes or greenhouses, or a small woodlot providing a village with fuel wood – creates a visible physical infrastructure similar to those of industry, retail, etc. CBUA makes productive use of available, often underutilised urban, suburban and periurban land for community benefit. In doing so, it represents an investment of shared effort on the land that has intrinsic aesthetic value (like the urban greening activities described in Chapter 14). Fruit-bearing street trees, a schoolyard with a thriving garden, and a busy street-side market clearly identified as a community endeavour are positive images to outsiders and a source of pride to community members. And at a different, more individualised scale, a home with a green roof, a dooryard garden and orchids growing in the kitchen has increased value. From a community development perspective, the principle of low-cost income-generating housing can be significant insofar as the value of each unit of the house is worth more than its shelter value.

Natural Capital

For 10,000 years, individual communities managed natural resources and biodiversity through mechanisms such as the commons, the sacred grove, the city forest, the annual assignment of user rights by community elders, and the public right of access to large bodies of water. Today, with large-scale environmental management primarily in the hands of governments and corporations, CBUA managers strive to incorporate modern principles of sustainable project management, such as composting and the reuse of solid wastes and wastewater, at a smaller scale. At one level, this represents simple practicality. Urban farmers are not inherently more environmentally conscious than rural farmers – they utilise urban waste because they farm the 2.5 percent of the earth where waste is most concentrated. But natural capital is further built in communities through the employment of newer techniques such as Permaculture and Agroforestry. Their employment in CBUA requires educating the community as to their rationale and methods, and their role as alternatives to other methods of food production. This strengthens communities in several ways, including building the self-confidence that encourages individuals to reach out and share this knowledge with others.

As with other dimensions of community capital, the building of natural capital lends itself appropriately to different forms of youth involvement. Growing Power, a community-based NGO currently operating in Milwaukee, Wisconsin and Chicago, has built its youth training programmes around its philosophy of advancing urban agriculture through small-scale, environmentally sustainable practices. Children participating in Growing Power's Youth Corps programme enjoy learning about and assisting with the low-tech, hands-on vermiculture and aquaculture projects that utilise donated outside waste products to produce vegetables, fish, and fertiliser made from worm castings.

The Establishment of Community-based Urban Agriculture Following Natural and Human Disasters

In this chapter, community-based urban agriculture has been presented as the result of a deliberate process of organisation that takes time to mature. Yet CBUA can be important in situations where time is of greater essence. For example, many, if not most, locations devastated by natural and human disasters have a need for the community-building practices of urban agriculture. Urban agriculture in post-disaster situations can provide several direct benefits to recovering areas: nutritious food, a mini-economy centred on food, useful new technologies, the conservation of local culture and the empowerment of women and youth. The experience of farming cooperatively during a crisis thus supports the community as it resettles in its home place. There is a basic procedural model. Just after a disaster, during their time in camps, refugees learn different urban agricultural techniques through technical training offered by NGOs, often humanitarian organisations. These techniques are then brought back to their home places upon leaving the refugee camps.

Bert Lof

Farmer's markets bring rural and urban products to the urban consumers.

Recent major natural disasters have created new CBUA opportunities. In summer 2005, hurricanes Katrina and Rita ravaged an area along the US Gulf of Mexico coast equal in size to many small countries. Because the storms occurred near the end of the growing season, traditional agriculture in a three-state region was severely damaged. To mitigate the loss, urban agriculture is being introduced on an interim basis. Raised-bed bio-intensive horticulture is being established in temporary mobile home parks, and small greenhouses are to employ innovative production methods. Internally displaced families are thus able to grow key elements of their traditional cuisine and supplement relief supplies with high vitamin and other micronutrient foods. A centuries-old way of life along the Gulf Coast will be at least partially restored.

On the other side of the world, the Sri Lanka Department of Agriculture has initiated a community agriculture programme to address the environmental, economic and, especially, the psychological damages resulting from the December 2004 tsunami. Authorities are offering to partner with residents (primarily in the western coastal districts of Kalutara, Colombo and Gampaha) to help develop projects ranging from the creation of "Family Business Gardens" within reconstructed housing, to small- and medium-scale agro-entrepreneurship, to the improved value-added processing of fish harvests. The psychological recovery of tsunami-affected communities thus is built upon the relief supplied by the sum total of individual urban food production activities.

The methods of CBUA are also of value to communities formed by human disasters such as armed conflict. The siege of Sarajevo in the mid-1990s, for example, forced residents to engage in urban agriculture to replace food supplies that once came from outside the city. A more recent example is Somalia, a nation that has been in a state of war for over a decade. Refugees have emigrated north to Ethiopia, south to Kenya and west to Sudan. In all three places humanitarian organisations have assisted the refugees to establish agriculture within their campsites. Displaced persons within Somalia, fleeing from fighting in the north to the more stable centre and later from the disintegrating centre to the south, have also received assistance in establishing more intensive methods of agroforestry, small livestock and vegetable production than had traditionally been practiced in their rural villages.

Martin Bailkey

Kenya Green Towns extension agent Elijah Githee instructs members of the Together Home Craft Self Help Group on in-ground seed planting techniques, Nakuru, Kenya.

The most extended projects have been along the border between southwest Somalia and northeast Kenya. Agriculture in Relief and Transition, a small group based in Washington DC, is a central agent behind the incorporation of food production into these camps. In this process refugees learn new skills in production, processing and marketing. Women are the predominant producers of vegetables and raisers of poultry, and also prepare food for local market sale (see for instance at www.theirc.org).

A positive outcome from this human disaster is that refugee women and men will eventually take home a new and more varied agricultural technology than that practiced before their displacement. At the conclusion of the crises several humanitarian organisations will move with the refugees to their former settlements and assist with the restoration of the local economy through the incorporation of these new skills.

Conclusion

The energy and motivation among city residents, particularly the poor, to allow urban agriculture to form a critical component of their shared wellbeing has been a constant in the history of community-based urban agriculture. The argument of this chapter is that the effective practice of CBUA, in both developing and developed nations, displays patterns similar to the best practices of local, place-based community development: self-determination, goal identification, the ability to access the necessary technical, financial and knowledge resources from outside the community, and the inclusion of marginalised segments of the community. Similarly, effective CBUA practice is accomplished by recognising from the beginning those dimensions of community capital – human, social, political, cultural, financial, built and natural – to be directly or indirectly enhanced through the creation and execution of the individual project. In essence, CBUA integrates and combines the actions and objectives of most, if not all, of the chapter themes contained in this book – community economics, gender, recycling and waste management, and the individual activity areas of urban agriculture (horticulture and forestry, livestock and aquaculture) – in a holistic manner.

Since 2000, CBUA has greatly benefited from the increased capacity of NGOs to support grassroots projects. In Cape Town, South Africa, Abalimi Bezekhaya (see the case study) represents a strong organisation focused at the local level. In North America, Heifer International has transferred the expertise gained at addressing hunger worldwide to projects in Canada and its home country of the US, particularly in Toronto, Chicago and New York. Heifer's North American projects have been particularly beneficial in immigrant communities, helping new Americans assimilate into new cities, while at the same time using farming to maintain important traditions of their home cultures.

Also in the new century, modern technology – the internet and mobile phones – is spreading new knowledge of organic and alternative farming practices developed by universities, extension services and other NGOs into more remote communities to improve urban agriculture production while also building the dimensions of community capital. In addition to longstanding problems of poverty and poor nutrition, community-based urban agriculture is being applied to more contemporary problems involving specialised sub-groups of larger communities. For example, in Kenya, Ethiopia, Zimbabwe, South Africa and other African nations, urban agriculture, in association with community-scaled health services, is seen as an important tool in the fight against HIV/AIDS (Small, personal communication).

While one is encouraged by the continued, and increasing, evidence of CBUA worldwide, one can also legitimately ask if the sum total of CBUA activities since the end of the last decade represents a true movement, or merely the simple aggregation of many disconnected examples. Many CBUA examples, such as Troy Gardens in the US, operate without the benefit of direct national and regional programmes that incorporate urban agriculture into community development planning. Commonly, national and municipal leaders and planners witnessing CBUA may simply see small initiatives on underused land, and not see the ways that these practices facilitate the same goals as their existing policy objectives. Advanced governmental policies supporting CBUA should begin with efforts to adapt the regulatory power of a jurisdiction to city farming practice. Recent guidelines to permit and regulate urban agriculture in Kampala, Uganda are based upon the recognition of its value to city residents. The guidelines go on to address the possible harmful effects of urban farming on the environment and public health (KUFSALC and Urban Harvest 2005). Such guidelines for Kampala reflect the well-known role of government as regulator in the public interest.

A more advanced form of government policy towards CBUA would go beyond regulation by identifying policy objectives within the separate dimensions of community capital as described earlier. For example, micro-enterprise loans can be provided to local community groups organising food distribution/marketing or some form of value-added processing and sale. In this role, government is not a barrier to CBUA as when it acts as regulator, but is instead a facilitator, supplying resources to self-directed groups that have displayed a requisite level of commitment and organisation to build their communities economically, and on their own terms.

With increasing urbanisation worldwide, community-scaled urban farming is assuming greater significance. Yet the opportunities for urban agriculture to strengthen both local food security and the economic and environmental health of cities are limited by the lack of widespread awareness of the multiple benefits of CBUA and by the general lack of relevant policies that recognise how CBUA is, in essence, an application of accepted place-based community development objectives centred around food production and community food security. Urban agriculture advocates would do well to remember this when urging increased support for their objectives.

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Abalimi Bezekhaya, Cape Town, South Africa	www.abalimi.org.za
The Food Project, Boston & Lincoln, Massachusetts, USA	www.thefoodproject.org
The Garden Project, San Francisco, California, USA	www.thegardenproject.org
Illinois, USA	
Growing Power, Milwaukee, Wisconsin & Chicago,	www.growingpower.org
Heifer International, Little Rock, Arkansas, USA	www.heifer.org
South Central Farm, Los Angeles, California, USA	www.southcentralfarmers.com
Troy Gardens, Madison, Wisconsin, USA	www.troygardens.org
Urban Harvest, Sub-Saharan Africa Region	www.cipotato.org/urbanharvest/regions/africa/index.htm

The Siyazama Community Allotment Garden Association, Cape Town, South Africa

Rob Small

Abalimi Bezekhaya (Planters of the Home) is the leading urban agriculture organisation in Cape Town. Abalimi provides support services such as supply of low-cost bulk compost, seed, seedlings, training and on-site project extension. Abalimi's two non-profit People's Garden Centres annually supply agriculture and horticulture inputs to, on average, 2,000-3,000 home-based survival and subsistence gardeners and approximately 200 community agriculture and greening projects. Abalimi projects are encouraged to be 100 percent organic. The economic potential for community agriculture is significant, as there is a high and ever-growing demand for organic vegetables in Cape Town. Organic markets and retailers both large and small are always undersupplied. There is now an increasingly organised community-based organic farming and gardening movement, led by associations such as the Vukuzenzela Urban Farmers Association (VUFA), which is supported by Abalimi[1].

SCAGA

The Siyazama Community Allotment Garden Association (SCAGA) is a member of VUFA. Since 1997 its members have farmed 5,000 m^2 in a corridor previously under power lines (low-intensity feeder lines that were later decomissioned) in Macassar, Khayelithsa. SCAGA could provide 3-4 permanent full-time formal jobs, but decided instead to become a Livelihood Level garden, with up to 30 subsistence "jobs", on a mixture of individual and communal plots. These form the centre around which a number of other entrepreneurial and service initiatives have been or are being developed. In SCAGA's case, a small seedling nursery, a craft group, and a tea and catering service have been developed, with future plans for a soup kitchen and child care facilities. Adjacent land within the same servitude corridor – some 3 hectares of sandy wasteland – has now been fenced and is being developed to accommodate another 200-300 gardeners.

Rob Small

SCAGA Garden how it looked before

Each SCAGA member receives a minimum cash and food income, after costs, of R50-R100 per month (US $ 7-14), a lifeline to households with no discernable income. In 2005, the project hosted its fifth group of 30 people successfully marketing high-quality organic produce. Group savings at year end, after costs and own consumption, have varied between R2,000-R 20,000.

This community oriented project of SCAGA has had far-reaching impacts, both within the local community and on policy development in Cape Town. It has sparked hundreds of applications from new groups and has given planners solid proof to argue for community-managed open spaces and for self-help job creation. SCAGA is repeatedly visited by VIPs, including local government Ministers and senior officials. The Western Cape Department of Agriculture (in contrast to its national counterpart) has recently begun to give some solid support to community organic agriculture projects, mainly in the form of improved infrastructure.

Impacts on the local environment have also been quite substantial. Soil fertility inputs have decreased, while pests, once a headache, are hardly mentioned now. Improved health is also becoming evident, as are the medicinal use of fresh organic food for immune system building and the all-purpose therapeutic value of organic growing. New members often come with signs of malnourishment. They have low energy and little money. After one season, frequent remarks on all-round health improvement are often heard.

Rob Small

And SCAGA Garden how it has changed

There have also been positive impacts on the position and role of women as leaders, through, for example, *Ilima* - traditional mutual-help work events. These have now become a practical tool in women's empowerment and mobilisation, facilitating to obtain community support and muscle power for SCAGA projects. It began with SCAGA women recruiting unemployed men to do heavy work by re-introducing a traditional rural practice – serving of traditional beer and food after the work is done. These events cost very little, but more importantly the women earn wide respect and support in the community by the work they do. SCAGA is now firmly women-led, and women-run projects are now the norm. On occasion, male SCAGA members, offer time to activities (without the women's additional responsibility of managing households). But friction arises whenever the men insist that all the food produced has to be sold. Such problems are now being minimised as female leadership is accepted. It has recently been decided that SCAGA men, while needed for the heavy work, should run their own gardens separately!

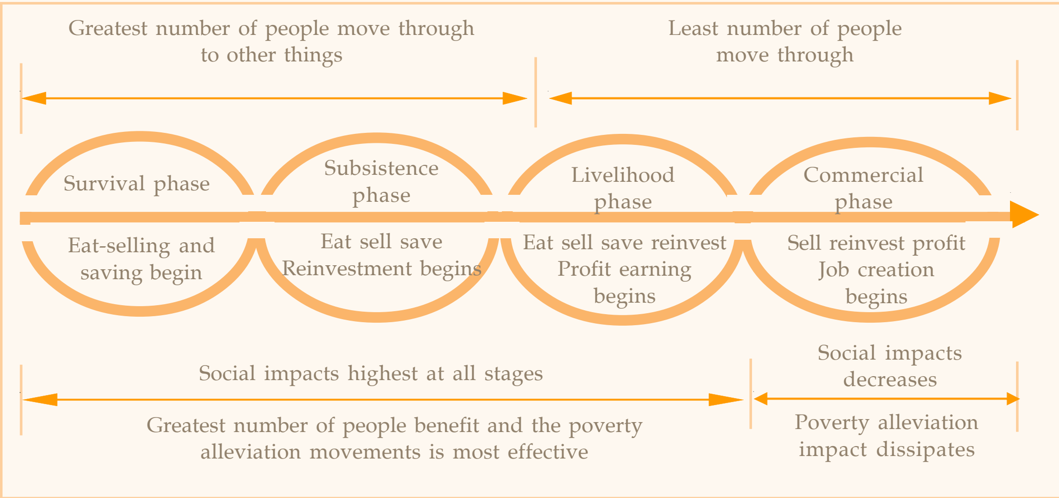
New developments

There have been two recent developments. First, a unique Development Continuum with measurements for project sustainability has evolved from actual field experience and is in the process of finalisation (see Figure 6.1). This continuum and measurement system tracks the development of community agriculture projects through four levels: from Survival, through Subsistence, into Livelihood and then to Commercial. The continuum takes into account social dynamics such as group conflicts and the "flow-through" of members, enabling these to become positive events rather than limiting factors. It is now known that new groups need about seven years to establish a relatively stable organisation for community agriculture, while sustainable-level skills and knowledge takes approximately three years to acquire within each level. The physical infrastructure for community agriculture, in contrast, can be delivered within one year – the exception being fertile soil.

The other new development, the Livelihood Garden, is a subsistence level garden with a commercial component that anchors several social and economic initiatives of the gardeners. These include crafts and refreshments for visitors and tourists, child care and soup kitchens (partly-funded by government grants) for the sick and needy, and seedling nurseries for the gardeners' use and for sale to others. In this way, garden activities become multi-functional entrepreneurial and community support initiatives.

To further extend the community development potential of SCAGA, Abalimi's organisation building arm uses tried and tested interventions to build farmer and gardener skills and organisational capacity (since 2000). Horizontal learning (farmer to farmer) exchange, action learning and savings mobilisation are key development activities in enabling development. Micro-credit to groups with consistent savings records will be available in the near future to projects entering the Livelihood and Commercial levels of the Development Continuum. Periodic farmers markets, tunnel greenhouses, cold-storage rooms and value-adding packing sheds will follow in the next years, supplying a wide range of produce for cooperative marketing and creating new livelihood and job opportunities for the poor. Organic certification is now being sought, whereby Abalimi and VUFA will obtain "bulk certification". Association members will then obtain certification more cheaply and thereby increase the external marketability of their products.

Figure 6.1 *The Sustainable Development Continuum for Organic Micro Farming Projects*



Box 6.5 *Development Continuum*

A step-by-step development continuum for community based agriculture has been developed (and will be ready for distribution in 2006). The development continuum takes the limiting factors into account and enables a constructive and empowering 'flow-through' of participants who have other aspirations and need to farm or garden only as a stepping stone. The notion of a development continuum is not new. However, a clear step-by-step pathway for the creation of sustainable community garden and farming projects definitely is. Distinct phases or levels have been identified from field experience, with sustainability measurements at each level. The continuum runs through four phases or levels, from Survival, to Subsistence, to Livelihood and finally to Commercial level. Energy is right now being wasted by donor agencies attempting to move Survival-level farmers up to Commercial level too quickly, while beneficiaries themselves are confused about which level they would like to achieve, or even if they want to be farmers at all!

Growing out of the continuum, Abalimi is developing a special training to provide community farmers and gardeners with sustainable assistance, while allowing 'flow-through' of temporary farmers. The training will enable both illiterate and literate people at Survival level to progress to the level that suits them, or to eventually achieve Commercial level. The training model also takes account of a new type of community garden that is emerging at Survival, Subsistence and Livelihood levels – this is the 'treatment support garden' which supplies fresh organic vegetables to the chronically ill.

From CSI Handbook, 2006

Abalimi is also determined to ensure that organic certification will not act as a deterrent to emerging players. It is developing a Master Gardeners training programme that, once accredited, will enable illiterate gardeners and farmers to move from Survival through Commercial development levels. This will also form the basis of a capacity building programme enabling genuine organic farmers to return to abandoned Eastern Cape lands.

The social impulse behind SCAGA, combined with its relative economic success to date, is South Africa's first example of sustainable urban community organic farming as a permanent lifestyle choice. Consistent with the best intentions of community development, there is no limit to what can be achieved by Cape Town's urban farmers once they find ways to work again on the land with trust and goodwill.

Note

[1] VUFA is currently networking with other emerging small farmer formations provincially. Abalimi assists VUFA in enhancing its national and regional links. It is hoped that, over time, the emerging national and regional organic small and micro-farmers associations will federate in order to leverage increased benefits to the poor. www.abalimi.org.za

Troy Gardens, Madison, Wisconsin USA

Martin Bailkey

In 1995, the State of Wisconsin offered for sale 6 hectares of former farmland on the north side of Madison, the state capital. For several years, a local anti-poverty NGO had been permitted to manage community garden plots on the site, with gardeners drawn from both the surrounding neighbourhood and elsewhere in Madison. Upon hearing of the state's wish to sell the land, gardeners and neighbours who valued the implicit quality of the site as informal public open space, organised to develop a strategy for keeping the rural character of the property. This began a 6-year effort that resulted in the sale of Troy Gardens (named after Troy Drive, which borders the land) – and to which the state added an adjacent 6 hectares – to the Madison Area Community Land Trust (MACLT) in 2001. MACLT now leases 10 hectares to the Friends of Troy Gardens (FTG) as undeveloped conservation land that will, by mutual and legal agreement, remain as open space for the community's benefit, and will build 30 residential units on the remaining land under the co-housing model (see www.cohousing.org). MACLT will price 20 of these units at levels affordable to lower-income home buyers, in keeping with its organisational mission to make housing affordable in Madison's increasingly expensive real estate market. For their part, FTG, a membership organisation run by a board of directors composed of community members, manages the different community-oriented programmes occurring on the site throughout the year.

Friends of Troy Gardens

Children proudly display the vegetables grown in the Kid's Garden program at Troy Gardens.

From its beginnings as a citizen reaction to the state's plan to sell the land, Troy Gardens has been marked by active community involvement. The existing community gardens established urban agriculture as a key component of the community's vision for Troy Gardens, and ideas for involving stakeholders with urban farming evolved over the years of discussion and planning. Part of the richness of Troy Gardens is based upon the fact that these stakeholders are not drawn from a single social group, but include middle- and upper-middle class whites, a strong community of Hmong refugees from Laos and Southeast Asia, local school-age youth, and smaller groups of African-Americans and Hispanics. Today, Troy Gardens forms a rich display of community-based urban agriculture, both in form and in culture. About one-half of the almost 300 community garden plots of 50m^2 are efficiently farmed by Hmong families, who typically grow high quantities of indigenous vegetables. The remaining garden plots are equally divided into an organic, non-tilled section and a section tilled before each growing season.

A short distance away from the community garden plots, past the displays of edible and Hmong medicinal plants, and past the 2 hectares of tall-grass prairie now being restored by community volunteers, sits Madison's first urban farm for larger-scale production. This 2-hectare community supported agriculture (CSA) farm completed its fourth year of operation in 2005. Under the CSA structure, individuals and families purchasing a share in the Troy Gardens farm prior to the growing season receive a steady supply of fresh, certified organic produce from June into October. There were 89 shareholders in 2005; of these 9 were worker shares (discounted shares for those doing significant farm work) and 4 were shares for low-income families, subsidised through outside donations of money. In addition to distribution through CSA shares, the Troy farm sold fresh produce once a week at an on-site market stand, and at two Madison farmers' markets. Produce was also sold at Madison's leading cooperative grocery. The farm generated an income of US$ 54,700 in 2005, and FTG, the farm's manager, projects an increase to over US$ 65,000 in 2006.

Multiple functions

The food production activities at Troy Gardens provide the framework for a rich variety of community-building activities. In addition to the daily sharing of experience among the community gardeners and CSA farm workers and volunteers, a number of programmes reach out directly to schoolchildren and high school students from Madison's north side. The successful Farm and Field programme offers job training and other skills to high school students aged 14-17 each summer through exposure to ecological restoration, organic farming and the marketing of farm products. And the Kid's Garden programme provides gardening, arts, nutrition, cultural and environmental education to children from the area's primary schools. The programme is designed to coordinate school curricula with on-site activities at Troy Gardens. The children plant and maintain their own garden beds and participate in arts and crafts projects that enhance the garden's appearance. Food grown in the Kid's Garden is brought home to participants' families, used for cooking lessons or donated to community centres and food pantries. In addition to youth activities Troy Gardens hosts several public events tied to the seasons, including a Savour the Summer Festival in August and a Harvest Festival in autumn. Whilst being a celebration of food and the changing seasons (important in the northern climate of Wisconsin), these events are enhanced by performances of Hmong music and dancing.


Friends of Troy Gardens

High schools students learn sustainable urban agriculture methods through the Troy Gardens Field and Farm project.

The permanence of Troy Gardens is a testament to the ability of several Madison NGOs with different missions to find common ground and work together on behalf of Madison's north side community, independent from significant government involvement. The community land trust model has been a valuable tool in ensuring that the acquisition of the land from the state occurs in the best interest of the surrounding neighbourhood (Caton Campbell and Salus 2003). Faculty and students from the University of Wisconsin-Madison managed to overcome community concerns that they would impose their own agendas and have become valued players in, among other roles, developing the Troy Gardens site plan, guiding the prairie restoration and improving the productivity of the CSA farm. Recently, as a way to introduce the local Hispanic community to Troy Gardens, the University helped FTG develop a production and marketing plan for *huitlacoche*, a naturally occurring corn fungus that has been a delicacy in Mexican cuisine for centuries.

Challenges

As with many similar projects, the success of Troy Gardens as an example of Community-Based Urban agriculture (CBUA) is balanced by several challenges. With no direct government support, Troy Gardens, like so many similar CBUA activities in the US, is dependent on grants and donations. The small FTG staff must thus spend significant amounts of time and energy seeking funds to continue basic operations. A second challenge has been to broaden the ethnic diversity of Troy Gardens' users. Apart from those participating in the youth programmes, the involvement of the surrounding Hispanic and African-American communities remains low, despite a number of outreach efforts. Finally, with the maturity of Troy Gardens as a coordinated series of community-based activities, the boundaries of its "community" are sometimes blurred. In most regards, Troy Gardens remains solidly-rooted in Madison's north side. Yet it is increasingly seen as a valuable amenity to the entire city of Madison. Given this perception, Troy Gardens' leadership has discussed the possibility of applying its community-building expertise in other Madison neighbourhoods, particularly those with low-income residents.

Troy Gardens was born under special circumstances. But hard work among dedicated community members, combined with outside involvement by individuals respectful of keeping ownership within Madison's north side community, has resulted in an exemplary model of CBUA – one that combines urban agriculture with other activities to form an integrated set of place-centred community-building practices.


Friends of Troy Gardens

The Troy Gardens farmer leads one of the many tour groups that visit the urban CSA farm each growing season

Reference

Caton Campbell, Marcia and Danielle A. Salus. 2003. Community and Conservation Land Trusts as Unlikely Partners? The Case of Troy Gardens, Madison, Wisconsin. *Land Use Policy* 20: 169-180.

Project 'Patio Comunitario': a community initiative to produce sustainable food

Justo Torres Lazo
Francisco Paz Barada

Background

The project "Patio Communitario" addresses the issue of access to food, which is one of the most severe problems impacting the quality of life of the Cuban population. The elderly, women, housewives, and children are the groups most affected by this problem. This lack of access to sufficient food has its origin in the economic crisis known as 'período especial' (special period) in Cuba in the late eighties, early nineties. The U.S. blockade and the disintegration of the European Socialist Block (that always supported Cuba before) made the Cuban government redirect the country's food production strategy towards organic production. It also provided greater entitlement of land to the people by forming new cooperative organisations known as 'Unidades Básicas de Producción Cooperativa' (basic units of cooperative production).

In Cuba's urban areas, agricultural activity has increased through 'organopónicos', (intensive organic gardens), state agricultural enterprises and small plots cultivated by individuals or labour centres. This redirection of urban activities has resulted in the ability to maintain an acceptable level of food products in the lunchrooms of schools, kindergartens and labour centres and in farmers markets. However, in spite of these advances, it has not been possible to provide food at reasonable prices to the majority of Cuban families.


Francisco Paz

One of the neighbours is harvesting from the patio garden

In Cuba, and particularly in the city of Havana, the resources designated for collection, transportation and disposal of urban waste have been significantly reduced during the crisis years. The situation has now become critical in terms of the risks to human health and the environment due to an increase of uncontrolled garbage dumps that have sprung up everywhere. The number of reported environment-related illnesses has increased. Respiratory diseases, allergies, intestinal diseases and recent epidemics of dengue are amongst these. Studies have revealed that about 60 percent of all household waste comprises of organic material (see chapter 8). Such a high volume of organic waste provides an excellent opportunity to produce organic fertiliser for plants (edible, condimental, medicinal and ornamental) and to provide food for small animals that are authorised to be raised in urban zones.

Canal District in the Cerro municipality

The 'Consejo Popular' (people's council) of the Canal district in Havana is aware of these problems related to waste management. Being one of the oldest neighbourhoods in the city, it has a high density of people living in deteriorating urban infrastructure. Local health statistics indicate a high incidence of environment-related diseases including stress. Community alternatives to deal with this issue and to create a change in the district's culture towards the environment and hygiene hardly exist.

The Canal district has many houses with 'patios' (courtyards) which could be used as spaces to raise animals, to grow fruit trees and gardens of medicinal plants, vegetables and spices.

Up to now, the patios have not been used in this way. This provides an opportunity to encourage people to use the patios for small scale organic gardens. People in this district have a high sense of ownership, which makes it easier to develop participatory projects that transform and benefit the neighbourhood.

The 'Taller de Transformación Integral' (Workshop on Integral Transformation – which is an institution of local government in Cuba dedicated to community work) of the Canal district has worked for years in collaboration with the population to support and create various social projects. They are aware of the necessity to take action on the issues mentioned above. And among the inhabitants there is enough knowledge and experience that could be used to jointly find local solutions to the problems.

The project 'Patio Comunitario', created in 1998, has been working for eight years on these topics and promoting urban agriculture within the community and has gained the people's recognition as well as the support of social organisations and the local government.

Box 6.6 *Permaculture*

Permaculture was developed in the seventies by the Australians Bill Mollison and David Holmgreen as an answer to soil, water and air pollution from agricultural and industrial systems. It is an approach and a design method that contributes to sustainable human development. Its philosophy and approach to the earth incorporates and connects microclimates, annual and perennial plants, animals, soils, water and human necessities in productive communities. Permaculture concepts have been developed based on the following ethics and principles.

Ethics:
Take care of the earth; take care of people; use the excesses of time, money and energy for the first two.

Principles:
Create systems that are: environmentally healthy, economically viable; able to satisfy our necessities; not abusive to people, the earth, other resources and do not contaminate the environment; and that are sustainable in the long-term.

Main Activities of 'Patio Comunitario'

Household food production

The project 'Patio Comunitario' promotes urban agriculture using permaculture designs in small spaces within houses (courtyards, balconies, flat roofs, gardens, lots, etc.) with the aim of producing vegetables, fruits, spices, medicinal and ornamental plants, and raising rabbits, chicken and guinea pigs. This activity contributes to improving family incomes in two ways: the participants don't have to buy those products which they produce and at the same time earn an extra income by selling the excess harvest to neighbours (mostly fruits). There are currently 20 family gardens in the district involved in the activities of this project. The project also aims to recover plant varieties that were traditionally used in Cuban kitchens, but have become scarce or are in danger of extinction. Chayote, Ñame, and Caimito (Cuban vegetables) are a few examples.

Recycling domestic waste

Another activity of this project is the recycling and reuse of a significant volume of the solid organic waste generated in households. This includes kitchen food waste used in vermiculture systems, for compost making and feeding small animals, and other waste such as boxes, bags, old tyres, car batteries, wash basins, containers etc. which are filled with soil and used as planting receptacles. Reusing waste in this manner diminishes environmental pollution and mitigates health risks caused by open waste dumps on the streets.

Environmental education and community training

The neighbourhood environmental education and training component is accomplished by hosting workshops, courses and conferences on a variety of environmental topics. These training courses are held periodically in the demonstration courtyard at the project's headquarters. The project pays special attention to environmental education of young people, who as future citizens would have the responsibility to continue and improve the work accomplished today. At the headquarters of Patio Comunitario, two environmental interest circles (groups) are being hosted. These circles use methods of non-formal education and are attended by 20 of the district's primary school students.

Once a week (on Wednesday) the children learn the importance of living in harmony with the elements of nature. They are confronted with the benefits of the trees, medicinal plants, and different forms of reuse and recycling in the community, while getting to know healthy lifestyle habits and how to contribute to keep the environment of their district and of Havana Bay clean. They receive this knowledge from volunteer instructors who are members of the project management group. The learning process is supported by the pedagogical techniques of 'Educación Popular' (Popular Education), through which the children come to understand the relationship between human beings, nature and society by the collective construction of knowledge and through their everyday experiences. Next to didactic games, drawings, songs and theatrical representations, they take on homework tasks of practical activities at home, in their block or at school, based on what they learn during each meeting. The children participate in preparing and planning these activities.

To support neighbourhood-level environmental education and training, the project has recently set up a Centre of Environmental Community Information. The information centre has a library with resources on the environment and healthy living. Workshops and conferences for plant and animal producers, housewives and children of the community are also being held at the centre.

Healthy Food Fairs

A healthy food fair takes place on every last Saturday of the month at the headquarters of Patio Comunitario and is the activity that generates the highest level of community participation. The fairs are organised by the neighbours with the support of community organisations and the Taller de Transformación Integral of the Canal district. The neighbours cook vegetable dishes and present them to the audience. The winners are selected by a community jury and receive a popularity prize. Specialists give lectures about healthy nutrition and lifestyles. The fair also places emphasis on the community's artistic talents. A children's procession, a painting exhibition and troubadours are among the activities organised that feature in the fairs for the enjoyment of the community.

Francisco Paz

The healthy food fair combine recreational activities with provision of information.

These fairs in the Canal district of Cerro demonstrate that it is possible to create community-initiated recreational activities which at the same time provide information on a healthy lifestyle. This initiative has allowed 'Patio Comunitario' to promote environmental lifestyle to parts of the population which don't have formal ways of receiving this environmental education, such as housewives and retired people. About 270 people have participated in this activity in the neighbourhood.

These activities have a significant environmental and social impact. They contribute to improving the quality of life in the community as well as to strengthening the cooperation among of all the social actors. These are the first important steps toward making implementation of the Local Agenda 21 in the district a reality. The achievements of this project will be used as good practice examples in the country to realise the dream of constructing sustainable communities that live in harmony with their natural surroundings.

Resources

Farming Inside Cities: Entrepreneurial Urban Agriculture in the United States.
Jerry Kaufman and Martin Bailkey. 2000. Lincoln Institute of Land Policy.
This working paper explores the feasibility of for-market city farming as a means of using vacant parcels in the centre of US cities, particularly those suffering the effects of deindustrialisation. Boston, Philadelphia and Chicago are used as case studies. The authors try to balance the opportunities of urban agriculture, particularly as a tool for community and economic development, with a series of constraints that must be addressed for these opportunities to be realised.

Entrepreneurial Community Gardens: Growing food, skills, jobs and communities.
Feenstra, Gail, Sharyl McGrew and David Campbell. 1999. DANR Publication No. 21578. Davis, CA: University of California Agriculture and Natural Resources
This study focuses on 27 projects in the US that started off as traditional community gardens and added on entrepreneurial components with the intention of increasing their community value. The projects are compared on a number of aspects: site characteristics, production and marketing models, participants and employment generated, levels of economic self-sufficiency, and other individual and community benefits.

CitiesPeoplePlanet
Herbert Girardet. 2004, Wiley-Academy
This book is of interest to any practitioner or policy maker involved in urban agriculture. In chapter 12, “Relearning Urban Agriculture”, the author discusses the beginnings of urban agriculture, how it has developed through history and from developing countries to the USA.

Continuous Productive Urban Landscapes: Designing Urban Agriculture for Sustainable Cities
Edited by A. Viljoen, 2004. Architecture Research Unit, University of North London, U.K. ISBN 0750655437
This book takes an architectural perspective on urban agriculture. It proposes a design for a new kind of sustainable urban landscape. The innovative concepts put forward in this book have substantial potential to enhance the future quality of life within our cities. The book is well illustrated with lots of photos, diagrams, maps and tables.

Agriculture in the City, 2001 Maria Caridad Cruz & R, Sanchez Medina, IDRC
In the 1990s Cuba instituted a food programme that included urban agriculture and farming in the city. Free markets were reinstated, production coops were linked with markets, land was redistributed and areas under export crops were converted to domestic food crops. This book describes Cuba’s urban agriculture programme and could be of particular interest to municipal, local and community authorities.

Gardens of Hope, Urban Micro-farming and HIV/Aids
De Zeeuw H. ETC Urban Agriculture, Abalimi and CTA.
ETC-Urban Agriculture in cooperation with Abalimi Bezekhaya (Cape Town) and the financial support of CTA (the Netherlands) organised a study visit cum workshop in South Africa (Johannesburg and Cape Town) on “Micro-farming and HIV-Aids” in August 2005. Twenty persons/organisations from Southern and Eastern Africa participated in the study visit/workshop and shared their experiences. The proceedings of this event are available at www.ruaf.org, and also published on this DVD.

www.foodsecurity.org/list.html
The COMFOOD listserver is a primary link between individuals and organisations addressing community food security in the US, Canada and globally. The listserver hosts discussions on current food security issues and announcements of relevant projects, conferences, articles, etc.

www.city.toronto.on.ca/health/tfpc_index.htm
A completely refurbished website with links to, among others, the Toronto New Food Charter and the “Growing Season” report by the Food and Hunger Action Committee of the City of Toronto.

www.eco-farm.org
The Ecological Farming Association, formerly the Committee for Sustainable Agriculture, is a non-profit educational organisation that promotes ecologically sound agriculture.

www.cbnrm.net
The Community-Based Natural Resource Management Network’s web site provides a powerful set of broad, robust and useful networking tools aimed at linking stakeholders.

www.worldhungeryear.org/fslc
This online Food Security Learning Centre is created to provide site visitors “with an in-depth look at common hunger and poverty issues facing many U.S. communities.” It contains subject categories on Family Farms and Nutrition, and subcategories such as Community Supported Agriculture, Community Gardens, Food Policy Councils, Farmers’ Markets, Farm to Cafeteria, and more.

Chapter 7

Local Economic Development and Marketing of Urban Produced Food

This chapter deals with the socio-economic impact of urban agriculture on income generation, poverty alleviation, urban food supply, livelihoods, as well as indirect costs and benefits for society including environmental externalities. Two levels of analysis are considered to assess this impact: the household and the city. The assessment of social and economic impact at the city level suffers more from lack of data than is the case at the household level. A main question is whether urban agriculture should be seen as an informal, residual, subsistence activity or as one that can shift from simple to enlarged reproduction of urban food, by making the best of its proximity to urban consumers and sustaining incomes in the long run.

Local Economic Development and Marketing of Urban Produced Food

Paule Moustier
George Danso

State of debates

If urban agriculture is attracting the growing attention of researchers, policy makers and diverse development stakeholders, it is mostly because it provides some answers to the unique social, economic and environmental challenges posed by fast urban growth (see also the preceding chapters). The dramatic speed of urban growth in developing countries has not been paralleled with the development of enterprises and infrastructure needed to absorb the new employment needs, by contrast to the developed countries where urban development has been much slower (Henderson, 2002). Finally, the context of fast liberalisation and restrictions in the public sector has reduced the possibilities of employment in public administration, traditionally a major provider of employment in cities.

Yet, peri-urban agriculture is still a subject of debate as regards its viability and the necessity for it to receive political support. In a challenging paper, Ellis and Sumberg (1998) provide a number of reasons why scarce public resources should not target urban agriculture. The report stresses that in the light of high land costs in urban areas and the fact that there is still not enough land to cater for housing and infrastructure needs, it would seem legitimate to let agriculture move towards rural areas whilst improving the transport infrastructure at the same time, as has been the case in Europe. Moreover, urban agriculture is subjected to many types of pollution and is itself a pollutant. In fact, urban agriculture takes advantage of market distortions and can be only transient. But most to the point, the authors looked at the lack of rigorous quantitative data to assess the social, economic and environmental impact of urban agriculture, and compare it with alternative sources of incomes in the city, alternative uses of land, and alternative sources of food.

Paule Moustier

A night wholesale market in Hanoi

In her analysis of the case studies prepared for the ETC Reader on urban agriculture in 2000, Rachel Nugent also points out the informal, small-scale character of UA, and its little impact in terms of income injection into the economy: “agriculture is a residual activity within imperfect markets. As such, it is conducted opportunistically and with relatively little investment. Farmers are more induced in self-subsistence rather than looking at income opportunities” (Nugent, 2000) The survival strategies of urban farmers has also been brought to the fore by Lipton (1977) as part of his famous “urban bias” theory in which he describes urban producers as “fringe villagers, waiting until penury forces them back to the land and meanwhile living on casual work or on their rural relatives”. In fact, UA is often presented with the characteristics found typical of the informal sector, which have been summarised by Cole and Fayissa (1991) as small size, family management, labour intensiveness and extra-legal nature. These characteristics generate what economists call the simple reproduction of the enterprise, i.e. the impossibility to generate more than the income necessary for the enterprise to pay for the inputs and means of production involved, and hence the impossibility for the enterprise to accumulate savings and invest in its development. This process has been particularly well described by a series of studies on UA in Zambia (Rakodi, 1988; Jaeger and Huckabay, 1984): poor gardeners are caught up in a vicious circle when they plant a garden because their jobs do not provide them with enough cash income to feed their family, and they cannot grow more food and thus save money because they do not have cash to buy agricultural inputs, eg., manure, wastes or fertilisers…a typical poverty trap.

César Jaramillo Avila

Women sell part of their produce at the market of Los Chillos in Quito, Ecuador

Yet, as discussed in chapters 1 and 4, empirical data on urban agriculture generated in the last ten years helps analysts to go beyond the image of the subsistence farmer as the dominant type in urban agriculture. The number of case studies on urban and peri-urban agriculture has increased rapidly and are a comprehensive and valuable source in evaluating the economic and market role and comparative advantage of farming in and around cities. The methods, both in terms of conceptual frameworks and data collection, have improved to take better account of the specific features of urban agriculture, especially its numerous non-market costs and benefits, as well as its non-market organisational features based on the logic of location and risk alleviation, for which economics of proximity, combining insights from spatial and institutional economics, provide relevant analytical tools. While a frequent focus of prior studies has been the opposition between the informal urban agricultural sector and the urban environment, particularly in terms of policy, the benefits of alliances between agriculture and the urban environment are given more attention now, and a more balanced appreciation of the conflicts and synergies is looked for (Van den Berg et al., forthcoming). It is only through such alliances that urban agriculture can break out of the transient remains of rural agriculture and really gain an "urban nature" as expressed by Donadieu and Fleury (1997).

Urban Agriculture and Livelihood Strategies

Diversity of livelihood strategies

According to UNDP (1996), 80 percent of families in Libreville (Congo), 68 percent of urban dwellers in six Tanzanian cities, 45 percent in Lusaka (Zambia), 37 percent in Maputo (Mozambique), 36 percent in Ouagadougou (Burkina Faso), 35 percent in Yaounde (Cameroon) are involved in urban agriculture. The involvement of so many people in urban agriculture indicates its centrality amongst informal-sector activities (Obosu-Mensah, 1999). Yet the reasons for getting involved in urban agriculture, and consequently, its social and economic impact, vary across different categories of households. A major feature of UA is indeed the diversity of the socio-economic profiles of actors involved, and their varying income and livelihood strategies. Thus, the valuation of socio-economic impact will be different according to the types that are referred to, and not taking this into consideration may lead to differing estimates. Several attempts to classify urban agricultural systems have been made (Bakker et al., 2000; Smith, 1999; Moustier et al., 1999) which can be summarised into the types below and of which the characteristics are found in Table 7.1 (additional types could be added including hobby farmers or speculators).

1. Subsistence home intra-urban farmers (intra-urban and peri-urban areas)
2. Family-type commercial farmers (intra-urban and peri-urban areas)
3. Urban and peri-urban agricultural entrepreneurs (intra-urban and peri-urban areas)
4. Multi-cropping peri-urban farmers (peri-urban areas)

Table 7. 1 *Summary of typology of Socio-Economic profiles*

	Home subsistence farmers	Family-type commercial farmers	Entrepreneurs	Multicropping peri-urban farmers
Location	U (P)	UP	P	P
Outlets	Home	Urban market	Urban market + export	Home + urban market
Objective	Home consumption	Income for subsistence	Additional income Leisure	Home consumption and income for subsistence
Size	Usually < 100m²	Usually < 1000m²	Usually > 2000m²	Usually > 5000m²
Products	Leafy vegetables, cassava, plantain, maize, rice, goats and sheeps, poultry, fruits	Leafy vegetables, temperate vegetables Poultry (sheep) (milk)	Temperate vegetables, fruits, poultry, livestock, fish	Staple food crops, local vegetables
Intensification (inputs/ha)	2	2 to 3	4	1
Gender	F	F + M	M	F + M
Limiting factor	Size	Size, land insecurity, access to inputs, water and services, marketing risks	Technical expertise, marketing risks	Access to inputs Fertility

The proportions may be different elsewhere. In East Africa the subsistence type may be more significant due to the availability of more vacant space within cities. In Latin America and Asia, the types definitely differ across cities.

Subsistence home (intra-) urban farmers

This category involves urban residents who farm around their homes or elsewhere near the city, mostly for subsistence purposes. They raise staple food crops, vegetables, small livestock, and sometimes trees. Drechsel et al., 2004) documents that every second household is engaged in some form of subsistence production in Accra, Ghana**.** The production is typically seasonal, and the output is used mainly for home consumption, in addition to market purchases. There may also be the occasional sale of the surplus in the market. These survival strategies have been documented by a number of case studies including the ones reviewed by Nugent (2000). Typical examples are maize growing in the districts of Yaoundé, Accra metropolis and Harare; rice growing in Tamale, Ghana and Bandim, Bissau (Armar-Klemesu, 2000; Danso et al., 2002a; Lindell,1995); and multi-cropped fields cultivated seasonally by elderly women in Brazzaville on the outskirts of the city. Food from subsistence type production is usually of better quality, lower in cost and is more consistently accessible than purchased food (Gerstl, 2001).

Strategies of family-type commercial farmers

Family-type commercial farmers appear to be the dominant type in terms of importance in urban food supply, if not in terms of numbers. The typical crops grown are vegetables. What these farmers have in common is a family background in agriculture, which may also be in relation to ethnicity. For instance in Buenos Aires where the vegetable growers are mostly Bolivian, the Japanese mostly grow herbs and the Italians grow trees (Craig et al., 2002). Another common feature of these farmers is that they have searched for alternative employment having experienced failures in their studies or former employment; this also reflects the difficult employment situation in African cities, especially for poorly qualified people. Three-fourths of the interviewed vegetable growers in Brazzaville mentioned failures in other jobs as mechanics, taxi drivers, cooks etc. before getting into agriculture. Urban agriculture thus enables the employment of urban people who are quite vulnerable from an economic point of view – yet not as vulnerable as the subsistence farmers. But the activity seldom generates enough income for savings and investment, all the more since access to land is insecure.

In contrast with subsistence urban farmers, who mainly produce for self-consumption, commercial urban and peri-urban farmers are involved in agriculture to earn a monetary income to pay for the numerous expenses in an urban environment (housing, children's schooling, medical expenses). Although they may consume some of their produce, it is only a small portion. Agriculture represents their main household source of income, which may be in addition to other sources of income. In Yaoundé, more than 70 percent of intra-urban farmers do not have other occupations (Temple-Boyer, 2002); this figure is 85 percent in Abidjan (Yappi Affou, 1999). In Yaoundé, again, 70 percent of commercial producers cited agriculture as their principal source of income, 21 percent cited a job in the formal sector and the remaining 9 percent cited petty commerce. By contrast to these figures, 67 percent of household food producers cited a formal sector job as their principal source of income, 20 percent cited petty commerce, and the remaining 13 percent cited their pension. While none cited agriculture as their principal income source, approximately half did say it was their second most important source of revenue (Gockowsky et al., 2004).


Paule Moustier

Retail vegetable trade in Hanoi

In peri-urban Hanoi, alongside commerce and craft work, agriculture still provides more than half of the incomes in a municipality such as Trung Trac (Lecostey and Malvezin, 2001).Forty f our of 100 farmers surveyed in Cagayan de Ore, Philippines, indicated vegetable production as their main source of livelihood (Potutan, 1998).

As the farmers' objectives are to get regular food and income and secure their livelihoods, the cropping system has to be risk averse, yet have high value crops to cope with small size of land. This is typically the case of leafy vegetables (see also section 7.4 and chapter 11), which are hardly sensitive to water excesses or shortages and to diseases. Their short cycles (two to three weeks) enable regular cash generation. The proportion of leafy vegetables in the cultivated area is 70 percent in Brazzaville (Moustier, 1996). In Yaoundé (Gockowsky et al., 2004), the focus on traditional leafy vegetables and green maize production is observed among both commercial producers and household food producers.

Production systems of this category display common characteristics: irrigation, use of organic matter, cultivation on beds, and small farm size (less than 1ha). This reflects the necessary intensification per unit of land in a context of high pressure on land. As the farmers have differentiated access to land and capital (the higher the capital, the higher the presence of men in the business), the production systems display variations in the following aspects: the nature of crops grown (low-risk and short cycle crops, eg. leafy vegetables, versus more risky and longer cycle crops, eg. temperate vegetables or ornamental crops); the nature of agricultural inputs; equipment; marketing strategies. The intensification strategies of vegetable farmers have been especially well documented in Kumasi, Ghana by Danso et al.,2002b (see the Kumasi case). Depending on the availability of land, type of production system and location of the farm, the labour requirement differs. In the urban areas, where plot sizes are small, domestic labour is enough to cultivate the land area. In most peri-urban areas, hired, permanent and domestic labour is employed, depending on the above mentioned factors. As the main objective is to get a continuous income, the farmers may change plots and type of crops according to the time of the year. This may give an appearance of seasonality and discontinuity in the farmers' business, but in fact the activity usually continues, although at various locations. While in the dry season, vegetables are grown along the rivers and polluted streams, and with water from dugout wells, shallow groundwater and pipe borne water, farmers may move to non-flooded areas during the rainy season. This was observed in Brazzaville and Bangui where farmers have access to sloping land enabling them mover to higher ground to cope with flooding. In Bissau, on the other hand, women farmers had access only to plots located along the river (the non flooded plots were cultivated by civil servants) and they had to stop growing vegetables in the rainy season, which also explained their limited income (Moustier, et al., 2001).

Urban Agricultural Entrepreneurs

The main differences between this category and the family commercial farmers are the scale of the farms and the use of salaried labour. Urban entrepreneurs, usually civil servants, businessmen or expatriates, invest in intensive temperate vegetable production, poultry keeping, fish farms, or fruit growing, often in combination or with income form other sources. They invest in infrastructure such as motor pumps, treadle pumps, shelters, buildings, and attempt at mechanising certain agricultural operations, eg. irrigation or land tillage. They rely on a salaried labour force for doing most of the tasks. They may lack an agricultural background and the cases of losses and failures are numerous. They often control the marketing of their produce, eg. through direct delivery to stores or with links to export companies. Some examples of this category are the producers of green beans around Dakar, the civil servants involved in fruit production around Yaoundé, the chicken farmers around Ouagadougou and the poultry producers in and around Kumasi. In peri-urban Hanoi, the possibility of access to capital leads to land accumulation and other, non-agricultural, activities. This additional income is invested in agricultural diversification (moving away from rice cultivation to fish-farming, arboriculture etc.) or commerce (Lecostey and Malvezin, 2001).

Paule Moustier

A supermarket shelf in Hanoi

Multi-cropping Peri-urban Farmers

This category refers to farmers who share many of the characteristics of rural farmers (and may be called "rurban" farmers), except for the influence of the city in terms of production outlets with a growing share of marketed output; sources of incomes, including agricultural and non agricultural; level of intensification; and specialisation (eg. having some vegetable fields). They are hardly threatened by urbanisation in terms of land pressure. This category of has been extensively studied in Cameroon IITA. The study reveals that agriculture is often only one of diverse options to generate food and income. Also see the case on Kumasi by Danso et al.).

Dynamics of change

An important question of course is whether an urban farmer develops from one category to another? Is it possible for a farmer to evolve from being a subsistence type to a more commercial type, generate sufficient income and savings to increase the scale of business, and even move on to being an entrepreneurial type? The observation that most entrepreneurs originate from sectors other than agriculture suggests that commercial family farmers find it difficult to increase their scale of enterprise, and that they reach little more than to maintain (reproduce) their livelihood. This is due to a trap in terms of farm size and available capital, common to many enterprises of the informal sector, viewed as refuge options rather than paths for development. Yet there are some examples suggesting possible avenues for dynamic accumulation and growth from UA. Vegetable farmers in Lome and Cotonou have moved from subsistence to commercial vegetable production, as their savings enabled them to use treadle pumps and then motor pumps, and most of them are now producing for export and local consumption (Keraita et al., 2003). In Kenya, contractual farming agreements with livestock agro-industries has enabled farmers to generate substantial incomes (Mireri, 2002). The initial conditions for farmers to enter into such a contract are space (being able to accommodate 300 chicks), the ability to pay for the costs for water, electricity, labour and basic equipment, and the payment of a deposit of US$ 0,8 per chick. A supporting system in terms of municipal legislation, technical skill development and credit provision is crucial for these patterns of accumulation.

Jelleke de Nooij

Suoshi, small park in horticultural production base

Interestingly, although they are often documented as a necessary condition for farmers to gain easier access to resources, markets and investment, farmers' organisations are rarely documented as successful in paving the way for economic development (see also the section on food markets).

Evaluating Economic Impact

Methodology

Reliable statistics on farmers' incomes are rare due to difficulties such as the diversity of farmers' profiles, seasonality of crops, continuous harvesting of crops (vegetables), scattering of plots and multi-cropping. Establishing a typology of urban farmers and traders and monitoring their incomes is suggested as a means of overcoming this problem. The typology of farmers should account for the variability of incomes in relation to land size, type of products, age, sources of incomes, etc. (see previous section). The typology of traders should account for the variability of incomes in relation to the position in the marketing chain (wholesaler or retailer), the nature of commodities, and the type of customers (popular versus wealthy), all of which vary according to the location of the market. Farmers' and traders' incomes should be monitored at different times of the year, ideally every month, to take account of the harvests of short-cycle leafy vegetables, or at least during two seasons, the season of maximum harvest (usually, the dry season); and the season of minimum harvest (usually, the rainy season).

In order to assess whether engaging in urban agriculture is a valuable opportunity for urban residents, it is necessary to find references for comparison. In terms of its role in supporting livelihoods, the income from urban agriculture should be compared with the budget necessary to provide for basic food, clothing, and housing expenses in the city. Comparison should also be made with alternative labour opportunities in the city, for varying levels of qualification: for instance, the farming income of a commercial farmer with no qualification can be compared with the income of a cleaner or a guard. The comparison with rural incomes enables to assess the benefits of moving from countryside to city.

Ideally, data on incomes should be computed for one unit of the different factors of production: land, labour, inputs, invested capital, to compare the activity with alternative uses of these factors, in particular for the most crucial such as land. This type of assessment will help to confirm the rationale of urban farmers to invest in crops with the highest returns per unit of land, eg., horticulture and aquaculture. Finally, indicators of risks should be obtained by asking farmers and traders about the variability of incomes (minimum, maximum, standard deviation), within a year and during the five years before.

In order to shift from the household level to the city level, it is necessary to have data on the number of stakeholders involved in farming and trading activities, of the different types, and to extrapolate data gained at the household level using the share of the different types in the total population. The total added value is a useful indicator of the contribution of the sector to the national economy, when compared with the added value of other urban sectors (eg., construction), or to the total urban gross domestic product.

Income from urban farming

A comprehensive overview of monthly farm income from urban agriculture in different cities is presented in Table 7. 2. Case studies conducted by CIRAD between 1989 and 1992 provide interesting estimates of commercial farmers' incomes in comparison to the income necessary for subsistence. In Brazzaville and Bangui, at the time of the surveys, market gardening yielded enough income to provide for the basic food requirements of the family, plus housing, clothing and schooling expenses (Moustier and al, 2004). Hence, even if the total number of farms is small in comparison to the total urban population, their functioning demonstrates that urban agriculture is one of the - too few - sources of stable income that should be protected and considered within a portfolio of other urban cash-earning activities with limited initial capital requirements.

In Kumasi, the incomes of urban farmers occupying open space in low- or bottomlands were estimated at US$ 400 to 800, which is 2-3 times the income they could make in rural farming (see case of Danso, et al 2002). Urban home gardeners in Ouagadougou are able to earn about US$ 4 (direct) and US$24 (indirect) per month. This estimation is comparable to the monthly GNP per capita of Burkina Faso (US$20), one of the lowest in the world (Gerstl.,2001). In Dar es Salaam, Tanzania, incomes generated from urban agriculture were larger than regular salaries of 67 percent of the respondents.

Following the logic of market forces, farmers develop their limited resource - land – by seeking to add highest value.. As the urban pressure on land increases, a change from food crops to market gardening, flower growing or fish farming can be observed. In Bangkok, shrimp farming, which brings in on average 1,400 bahts (US$ 34) per hectare per year, is developing and replacing market gardening that brings in only 200 bahts (US$ 5) per hectare per year, which once replaced rice farming that brought in 40 bahts (US$ 1) per hectare per year (Vagneron et al., 2003). Greater distances from city centres means lower land prices and higher transportation costs; there is an optimal distance at which it is the most economically viable to practise agriculture, in terms of highest added value per hectare, as we can see in Figure 7.1. Around Hanoi, agriculture is most intensive 20 kilometres from town, in Dong Anh and Tu Liem Districts, which gives these areas the highest per hectare added value of 85 MVND / ha (5360 US$ / ha).

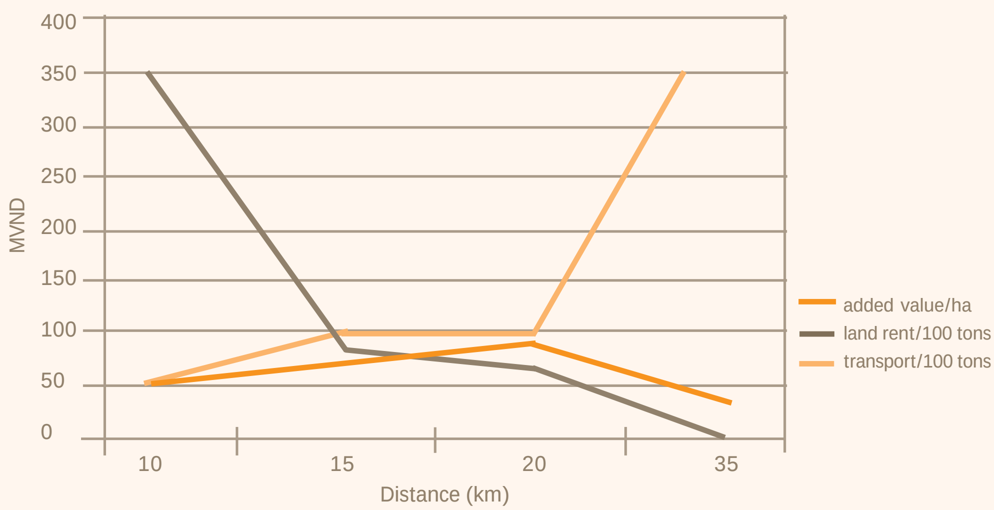
Table 7. 2 *Monthly net income from irrigated mixed vegetable farming in West and East Africa (US$ per actual farm size)*

City	Typical net monthly income per farm in US$[1]	GNI per capita (US$/ month)
Accra	40 - 57	27
Bamako	10 - 300	24
Bangui	n.d. - 320	22
Banjul	30 - n.d.	26
Bissau	24	12
Brazzaville	80 - 270	53
Cotonou	50 - 110	36
Dakar	40 - 250	46
Dar Es Salaam	60	24
Freetown	10 - 50	13
Kumasi	35 - 160	27
Lagos	53 - 120	27
Lome	30 - 300	26
Nairobi	10 - 163	33
Niamey	40	17
Ouagadougou	15 - 90	25
Takoradi	10 - 30	27
Yaounde	34 - 67	53

Note: GNI – General Net Income (UN statistics); n.d. = not determined / reported
Source: Dreschel et al. (2006)

[1] Some reports lack information on the time / period (number of harvests, seasons) the revenues are based on. Only a few valued family labor input and depreciated for investment costs. Data were combined in case of multiple reports per city.

Figure 7.1 *Impact of distance from Hanoi on agricultural added value per hectare*



Source: Le Duc Thinh (data from 2002, to be published): 1$=15850 VND

Valuation of environmental, social and health impacts

The field of economics has evolved a great deal in the past ten years to better integrate the value and cost of non-marketed goods. As was pointed out by Pareto in 1906, the value of goods is determined by rarity and need. But the availability versus rarity of goods is not necessarily reflected as a financial cost, because the cost may be delayed in time, or not necessarily easy to measure, or because a market does not exist at all. This is typically the case of health or environmental damages, the costs to the population of which are not directly and immediately paid for. Likewise, the needs for some goods or services are not necessarily translated into a market demand, as is the case of environmental preservation for future generations. Economists refer to these indirect costs and benefits as externalities that cannot be translated into the immediate equation of supply and demand. It is legitimate to try to evaluate the indirect costs and benefits of urban agriculture. Land is sometimes used free-of-charge by urban farmers, either because their presence is tolerated on idle land such as near airports (eg. in Cotonou or Bangui), by the side of main roads (in Nairobi) and under pylons (in Accra, or Cotonou) or because the government has lent some land to them in appreciation of the social role of urban agriculture (in Cuba- Moscow, 1999). But this free use does not mean that the land is of no value to the farmers; in fact, it may actually be a first step towards income generation and becoming capable of paying for more adequate and sustainable land resources. Another typical non-financial benefit of urban agriculture is the role it plays in greening the city, flood proofing and acting as a buffer against urban encroachment. This benefit can also not be captured in direct financial terms.

Paule Moustier

Labelling water convolvulus for supermarkets in Ho Chi Minh City

In order to convince policy-makers of the indirect costs and benefits of urban agriculture, and of the necessary policies to enhance the benefits and reduce the costs, indirect methods of valuation have been tested in certain urban case studies (Henn et al.,2002; Danso et al.,2005). Contingent valuation methods are based on creating shadow markets - simulating shadow situations where people would have to pay for or accept some goods and services and asking people what they would do in such situations.

When damage created (by farming in the city this case) can be repaired (which is not always the case), the costs associated in repairing such damage can provide an estimate of the environmental cost of the damage.

Contingent valuation (CV) has been developed to estimate the users' willingness to pay (for a certain good). A good example of CV is the case study in Cuba (Henn and Henning UAM no.7, 2002) where farmers were asked about their willingness to pay for continuing gardening on their land based on two hypotheses: (i) on their present land; (ii) on land improved in terms of water access and protection from theft. The willingness to pay was appraised by bids, starting from a given amount and then increasing or decreasing it until it reached the acceptable amount. The result is was a value equivalent to 11 percent (without improvement) and 14 percent (with improvement) of their total monthly income, or US$ 344,000 when extrapolated to cover all urban farmers.

In Bangkok, the willingness of farmers to pay for clean water (which is affected by industrial as well as agricultural pollution) was estimated in a similar procedure of decreasing and increasing bids, starting from 1,000 baht per year (US$ 24). The average amount that the farmers are willing to pay for unpolluted water is 1,196 baht / ha / year (US$ 29), and 1,025 baht / ha / year (US$ 34) when including the farmers who are not willing to pay for unpolluted water. The average amount is higher for vegetable (3,200 baht / ha / year=US$ 77) and shrimp (890 baht / ha / year=US$ 21) farmers than for fish farmers (220 baht / ha / year=US$ 5).

Taking account of the indirect costs of environmental damage enables us to have estimates of the economic sustainability of UA for farmers. In Bangkok, when taking into account the costs associated with cleaning the water and making up for soil depletion, shrimp farming the most polluting activity- still remains the most rewarding activity, but the income per family worker reduces by 10,100 baht / year (US$ 242), and growing vegetable becomes slightly more profitable than raising fish (Vagneron et al., 2003).

However, the consistency of contingency evaluation methods may be questioned. Indeed, when asked whether they are ready to pay more to access clean water, most farmers are - at best - sceptical. Paying more for a hypothetical service often seems out of the question since many farmers already struggle to cover their expenses. Declarations from simulations may not reflect the true behaviour in a real situation. Despite its difficulties, this method is still takes us a way forward in making more adequate consideration of the undisclosed costs and benefits of UA to society.

The Integration of UA in Food Markets

The specific role of UA in urban food supply

There are now more balanced approaches in considering the areas (rural or urban) for urban food production. A growing body of evidence supports the complementarity between the two forms of urban food supply. This change in perspective also implies a change in methods in the sense of combining the insights of geography, which helps identify product flows towards urban markets, with spatial economics, which enables a better understanding of the economic reasons behind the location of supply sources, in particular the relationship between the proximity of production and consumption areas and the perishable nature of the products. Substantial study on spatial economics has been done by Von Thünen (1851), and his insights have been commonly used by researchers on peri-urban agriculture. New insights of spatial economics, using inputs from institutional economics and sociology, go even further in the analysis of the influence of market proximity on production characteristics. They transcend the physical attributes of transport, storage or land costs or “physical proximity”, and focus on relational proximity, eg. interactions between farmers and market agents, farmers and consumers, and also within the farming community itself.

The revelation of the specific role of UA in urban food supply has also benefited from more rigorous data collection, which recognises that only comparing yearly production and consumption in the city has a number of limitations. These limitations include difficulties in grasping the perishable, seasonal nature of products or not considering the destination of products. Appraising the precise role of UA in urban food supply implies surveys in wholesale and retail markets, and questions on origin and quantities of products traded at different times of the year to take account of seasonal variations. This type of data collection is not easy as, for instance, most fresh products are sold either early in the morning or late in the evening or in the night. When limited by time, such studies should focus on some key products, at least fresh vegetables, as they provide the bulk of what is supplied by urban areas. Increasingly, studies in urban food systems are undertaken in the USA. CIRAD studied food markets in Central Africa and more recently in Vietnam, Laos and Cambodia. SIUPA has also supported the quantification of cassava flows to Yaoundé by an IITA led team, and IDRC has supported similar studies in Ghana via IWMI (Drechsel et al., 2004).

The specific role of UA in the supply of perishable food commodities

Basic food products (cereals or tubers) and dry vegetables (onions) come mostly from rural areas in the country or are imported from abroad. However, current data confirms the importance of UA in the provision of fresh perishable vegetables, mainly leafy vegetables, poultry and dairy products mostly from peri-urban areas (see Table 7.3 for comprehensive data on Kumasi, Ghana and Table 7.4 for various cities in Africa, Asia and Latin America).

Table 7.3 *Origin of different Food Items Sold/Consumed in Kumasi, Ghana*

Food item (Examples)	Metropolitan area Source (%)	Peri-urban Kumasi Source (%)	Rural and import* source (%)
Cassava	10	40	50
Maize	< 5	5	90
Plantain	< 5	< 10	85
Yam	0	0	100
Cocoyam	< 2	< 10	90
Rice	0	< 5	95
Lettuce	90	10	0
Tomatoes	0	60	40
Egg plant	0	60	40
Onions	0	0	100
Spring onions	90	<10	0
Poultry / eggs	15	80	< 5
Meat	5	10	85
Fresh milk**	> 95	<5	0

* Imported are mainly rice, onions and part of the livestock (meat)
** University farm (same in Accra) Source: Cofie et al., 2003.

Fresh vegetables in this category are mainly leafy vegetables such as amaranth, sorrel, morel, cabbage, lettuce and chives. These vegetables top the list of vegetables consumed, in Africa and in Asia. These vegetables are well known for their short shelf life: after one day they are no longer fresh – and in many countries, freshness is an important criterion for consumers who do not own refrigerators. These leafy vegetables are mostly brought into town from distances of less than 30 kilometres from the city centres, be it in Africa or in Asia. The peri-urban percentage of supply is more than 70 percent.

In Africa, improved broiler chicken, milk and eggs come from city farms or from the suburbs. These farms are run by city dwellers, whereas local beef comes from traditional pastoral or agro-pastoral farms. Urban animal food products are also imported from lower-end European production facilities and pose strong competition to certain local products, such as chicken, despite differences in quality (Guérin, 1998). In Addis Ababa, 20 million litres of non pasteurised milk come from back-yard city farms and are sold directly to the consumer by the producer. Butter, on the other hand, comes from rural areas and from as far away as 650 kilometres from the city (Bonnet and Duteurtre, 1998; Tegegne et al, 1999). In Kumasi, 95 percent of fresh milk consumed in the city is from urban agriculture.

Complementarities in Time

A comparative advantage of (peri) urban agriculture may be in the continuity of product supply, either because of specific natural conditions, or because urban farmers are able to sustain continuous production due to more specialised and irrigated systems - characteristics they may share with some specialised rural areas (the case of Lome and Accra). This is also observed in the dry areas of Mauritania, where peri-urban agriculture is able to supply the market with vegetables on a more continuous basis than the rural areas (Laurent, 1999). In Bangui (David, 1992) and Bissau (David and Moustier, 1993), the share of UA in the vegetable supply increases by 10 percent in the dry season. This comparative advantage is observed especially in the dry season for temperate vegetables, because in the rainy season, the access to non-flooded areas is easier in rural areas. In Hanoi, while 75 percent of tomatoes sold during the cold season are grown less than 30 km from the city, 80 percent of tomatoes sold in the rainy season originate from China and 15 percent from Dalat, located more than 1000 km away from Hanoi (Hoang Bang An et al., 2003).

Table 7.4 *Percentage given to urban production in urban supply*

	Leafy vegetables	Tomato	All vegetables	Maize	Plantain banana	Milk
Brazzaville (1)	80	20				
Bangui (2)	80	40				
Yaoundé (4)	80	25		90	60	
Bissau (5)	90	50				
Nouakshott (6)	90	10				
Dar es Salaam (7)			90			60
Dakar (8)			60			
Kumasi(9)	90	60		10	15	
Hanoi (11)	70	0 to 75 according to season	40			
Phnom Penh (12)	100	0 to 50 according to season				
Vientiane (13)	100	20 to 100 according to season				

Sources: (1): Moustier (1999) ; (2) : David, 1992 ; (3) : Mbaye et Moustier, 2000; (4) Dongmo, 1990 ; (5) : David et Moustier, 1995; (6) : Laurent, 1999; (7): Jacobi and al (2000); (8): Mbaye and Moustier (2000); (9) and (11) : An et al., 2003 ; and Phuong Anh and al., 2004; (12): Sokhen, Dianika and Moustier (2004); (13): Kethongsa, Khamtanh and Moustier (2004); (14): Yi-Zhang and Zhangen(2000). See also Urban Agriculture Magazine 2002 special edition for world food summit for other figures).

The Advantage of Proximity in Market Organisation

Short marketing chains

Urban products are distributed through very short marketing chains (see figure 7.2). The shortest is direct producer involvement in retail sales: this is the case of 30 percent of all sales in Bangui (David, 1992) and 70 percent of those in Bissau, when private trade had just been legalised (David and Moustier, 1993). More often than not, the producer sells to retailers. This transaction takes place at the field or at night wholesale markets (in Brazzaville, Bangui, Bissau as well as in Hanoi, Phnom Penh or Vientiane – see Moustier and David, 1997; Sokhen et al, 2004; Kethongsa et al, 2004). The quantities collected are small: between 5 to 10 kilos of collected and sold produce per day per retailer / collector in Brazzaville. In Hanoi, more than 40 percent of all wholesale market sellers are also producers; this percentage goes up to 100 percent for water convolvulus. Producers bring 100 to 200 kilos per day to wholesale markets on overloaded bicycles or scooters.

Figure 7.2 *Marketing chains for UA and rural agriculture*

Short peri-urban vegetable commodity chain Farmer → (Collector) → Retailer → Consumer
Long rural vegetable commodity chain Farmer → Wholesaler Collector → Wholesaler Distributor → Retailer → Consumer

The strong involvement of farmers, or their relatives, in the processing and marketing of their products, can be termed as vertical integration (see the case of Brazil of PROVE), which has a positive impact on the reduction of transaction costs in the marketing of perishable products, of varying quality standards[1]. This involvement in the chain of production is also explained by the small-scale of production and low prices, making it attractive for producers to spend some hours in transportation to get as much as possible of the final price. Yet these characteristics contribute to further fragmentation of the final supply, while economies of scale could be reached by collective marketing. Experiences of collective marketing are hardly developed in peri-urban areas though, or have had little success, given the variability of production in quantity and quality that makes farmers reluctant to "put their eggs in the same basket" as other farmers who may be unsuccessful and pull down the marketing results. Yet there are some successful examples when farmers have shared similar characteristics, and have identified reliable marketing outlets. Examples are the vegetable cooperatives in Hanoi and Ho Chi Minh City, as well as the vegetable farmers' groups in Yaoundé who have organised themselves to sell by a rotation formula. The cooperative horticultural marketing by HOPCOMS in Bangalore is another example (Premchander, 2003 (UAM no.9). Yet such experiences, and especially their economic efficiency in comparison to individual marketing, are not sufficiently documented.

Relational proximity is a common feature of the link between farmers and traders in developing countries, especially for perishable products. This has been documented by a number of research studies on marketing chains from rural as well as peri-urban areas[1]. What may be more specific to peri-urban areas is the existence of relational proximity between farmers and consumers, and the possibility of direct links between them, as at farmers' markets where farmers meet consumers directly. These have been especially well documented by Kirwan (2004) in England. In the USA and Europe, urban and peri-urban farmers seek to market their - especially locally grown organic - produce at farmers' markets. The number of farmers' markets in the USA had increased from 1755 to more than 2746 in 1998 – but direct sales from farmers to consumers only represented 0.3 percent of the market value in 1997 (Heller and Keoleian, 2000). In developing countries, direct sales are also observed as a way of promoting organic or IPM vegetables, eg. Farmers' direct delivery to a group of consumers organised in Hanoi and in Phnom Penh with the support of a marketing company and an NGO respectively. This has also been observed among mushroom farmers in Accra who do door-to-door delivery of fresh mushrooms to targeted consumers (Danso et al.,2005).

Low price differential

Short marketing chains contribute to a low price differential for products between farm and final consumption: these account for 30 percent on leafy-vegetables, 35 to 50 percent for cabbage and 75 percent for tomato in Hanoi (Gia B.T., 1999; Son et al., 2002). In rural chains, wholesalers' incomes may be up to ten times higher than that of farmers, but the risks of bankruptcies are higher. Price differentials are higher for rural products due to higher transportation costs and higher wholesalers' margins. While the price differential for peri-urban vegetables in Congo shifted from 1 to 2 from farm to retail, the price differential was 1 to 3 for rural vegetables, 20 to 80 percent of the marketing margin being absorbed in transport costs (Moustier, 1995). And in Havana, Cuba, the prices of tomato, onion, pork and fruit fell from 1 to 3 between 1999 and 1994, the period when the urban agricultural programme was launched (Novo, 2002).

Information on quality and control

The proximity of production areas to consumers, makes it easier for consumers to control quality, and at the same time, keeps producers from cheating on product quality. Most of the supermarkets, shops and restaurants in Hanoi are supplied by three cooperatives located in the peri-urban areas where production along IPM or organic standards is certified by government bodies. Likewise, in Ho Chi Minh City, the cash and carry supermarket is supplied with leafy vegetables by a peri-urban cooperative which gets the support of the department of agriculture and labels their vegetables as safe. Proximity enables frequent contacts between farmers, traders, and consumers and checks on the production process. Proximity between farmers and consumers is not a perfect substitute for independent public control, which is still deficient in Vietnam, but it does reinforce the incentive for farmers not to deceive their customers.

Freshness

In situations of limited access to fridges, freshness of produce is especially valued by urban consumers. In Thiès (Senegal), more than 90 percent of 150 interviewed housewives thought that vegetables should be grown nearby, for freshness and quick access (Broutin et al, 2005). In Vientiane, freshness is the criterion of vegetable choice stated by the highest number of consumers (71 percent out of 100 interviewed, in Potutan et al., 1999). In Hanoi, freshness is the advantage of peri-urban vegetable production cited by 74 percent respondents out of 500 in 2003 (Figuié, 2004).

Enhancing Social and Economic Impact

Acknowledging the multi-functionality of UA

Urban agriculture creates landscapes, which is a public good from which users cannot be excluded. This makes urban land management of little interest to the private sector (Donadieu and Fleury, 1997). Urban agriculture produces other things of value to the public: food security, social inclusion and jobs. Within cities, there are other sectors that create landscapes such as parks, to which UA can be linked to and compared with. The advantage of urban agriculture over other 'landscape producers' is that its functioning is supported by market forces, even if these markets are imperfect. It is thus a less expensive landscape producer than a public park. It also provides jobs and social inclusion (esp. Latin America). This multi-functionality of urban agriculture[2] makes it a 'cheap' producer of public goods. Table 7.5 compares the 'scores' of three urban sectors: industry, public spaces and agriculture in terms of the production of different goods and services. It shows that agriculture gets the highest combined mark. An increased distance between urban centres and agriculture is, however, inevitable if market forces are given a free hand. Hence, from a political economic viewpoint, it is legitimate that the public sector supports UA agriculture. Four areas of support are particularly relevant: integration into urban planning (see Chapter 3); financial support (see Chapter 4), research and extension for more profitable and sustainable intensive commercial vegetable and animal systems (Midmore and Jansen, 2003; Smith et al., 2004; and Chapter

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Fields of leafy vegetable basella (*Basella alba*) covered with straw mulch in Hanoi rural district

10); and innovative marketing, which will be elaborated in the next section. Municipalities have a crucial role to play in organising such support, in collaboration with national and international programmes.

Table 7.5 *Comparative multi-functionality of three urban sectors*

Products	Sectors		
	Industry	Parks	Agriculture
Landscape	-	+ +	+
Economic good	+ +	-	+
Job - Social inclusion	+	-	+
Food security	-	-	+ +

Source: Moustier (2003); Donadieu and Fleury (1997).

Innovative marketing

Farmers' organisation and information

As established in the previous section, the proximity between production and consumption brings undeniable comparative advantages for marketing yet it also brings some constraints. The small size of gardens and the problems of access to land result in the scattering of plots and the small volumes of transactions. This fragmentation of production (in place and time) makes the circulation of information on market supply difficult among farmers. A solution to this problem is the provision of timely market information to stakeholders: examples are available for Hanoi (see http://www.avrdc.org/susper) and Brazzaville (Moumbélé and Moustier, 1995). A solution to transaction volume is to support farmers' cooperation in terms of marketing to limit market gluts or deficits (see the example of the marketing manager in Ghana). Although farmers' organisations can never completely reduce supply instability, which is mostly generated by the impact of the climate on production, it can nevertheless partly reduce it. It can also generate economies of scale. Farmers' organisation should not be imposed from outside but rather be sought on the basis of existing groups sharing common interests and having developed relationships of trust.

Labelling safe UA products

The internal and external sources of product contamination are manifold in peri-urban areas, but the control of quality is made easier by farm proximity to consumers. Farmers investing in quality control efforts should therefore ensure that their products are recognised by customers as such, so that they can keep customer trust and profit from their investments in maintaining quality.

Some successful examples of peri-urban cooperatives that have developed adequate labelling of their vegetables, based on organic or IPM guidelines, are observed in Vietnam (Hanoi and Ho Chi Minh City). The Van Tri cooperative is an interesting example of successful collective action and vertical integration in the chain. The direct sales of Van Tri vegetables by the producers allow regular contact with the consumers, who ask questions and are given answers concerning the production methods used by the cooperative (Moustier et al., 2005). A similar involvement of a peri-urban farmers' group in the production and marketing of safe vegetables, with the labelling including the origin of product and methods of production, and delivery of a supermarket, is observed in peri-urban Ho Chi Minh City (Phan Thi

GiacTam, forthcoming). In Senegal, it is mentioned that in contrast to many industrial producers, urban micro-enterprises may survive by closer contact to consumers through their personalised labels (Fall et al., 2001).

In the Dutch city of Delft, a farmer was able to negotiate a 12-year lease on 35 hectares of land with the municipality thanks to his commitment to producing organic vegetables and milk, and also setting aside five hectares of the land for nature preservation (Deelstra et al., 2001).

Although it does not specifically target urban areas, Prove in Brasil (small agricultural production programme) is a successful example of multi-dimensional programme aimed at developing small-scale enterprises, especially in regards to processing of agricultural products (see case) (Homem de Carvalho, 2001).

Challenges Ahead

Collecting homogeneous and comprehensive impact indicators

The discussion above has shown how difficult it is to get comprehensive indicators of social and economic impact for all the different sectors involved in urban agriculture. The majority of cases mentioned deal with vegetable growing. Subsistence or commercial farming types are usually taken into account. A comprehensive list of indicators, at household and city level, is presented in table 7.6, and could be the basis for collection of data in different cities of Africa, Asia and Latin America. This is especially important in order to convince local, national and international decision-makers on the economic role and viability of UA.

Combining economic and market studies on a commodity chain

Economic studies tend to focus either on farms or on markets, but studies carrying out economic analyses all along the chain from farm to consumption are still limited and should be developed. These studies should provide for a comparative evaluation of rural and urban agriculture in order to show comparative advantages. They should further evaluate the economic impact of successful marketing strategies by farmers including quality promotion. And for these studies to be really meaningful, they should focus on one product that can be supplied by different geographical sources (for a comparison between rural versus urban agriculture, tomato would be a good example), or by different marketing strategies, and they should be carried out at different periods of time to take account of seasonal variations.

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Fishing in a pond in Hanoi rural district

Strengthening the analysis of development dynamics and poverty impact

Although the image of urban agriculture has gained more appreciation and moved slightly beyond “subsistence / simple reproduction”, there is still insufficient case material on enlarged reproduction, capital accumulation and spill-over effects from innovative commercial farmers. In-depth case studies on the “success stories” of such innovative farmers, who have been able to save up and develop their business, over different time periods, would serve in assessing the viability of these cases and further improving the image of UA.

Appraising the future of neighbourhood agriculture in global commodity chains

The development of international trade, as well as the globalisation of capital in food distribution is now well documented (see in particular Mc Michael, 1984; Reardon and Berdegué, 2002). This creates risks of growing distances between food producers and consumers, and reduced possibilities for citizens to exert control on the way food is produced, i.e. decreased food sovereignty: « From a food-democracy viewpoint, one's right to be fed needs to embrace one's right to feed oneself » (Koc et al., 1999).

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Promoting marketing as part of Rosario's UA action plan

Durability of food is developed at the expense of its sustainability (Friedmann, 1994). "More rapidly and deeply than before, transnational agri-food systems disconnect production from consumption and reconstruct them through buying and selling (ibid, p. 272). The pressures to reconstruct regional links between producers and consumers is apparent in many places, whether from economic desperation or from urban politics that place a high priority on ecologically-sound land use and uncontaminated foods than on the social and technical imperatives of mono-cultural farming" (ibid, p. 272 and p. 274). The life cycle assessment of the US food system has shown the lack of sustainability of the system, in particular the high cost of energy involved in transport, packaging and refrigeration: the food system absorbed around 5 percent of the total energy consumption in 1991 (Heller and Keoleian, 2000).

The impact of the development of supermarkets and restaurants on the characteristics of supply chains, including proximity versus distance aspects, needs more attention. As seen in the previous section, the proximity between production and distribution can confer advantages to peri-urban farmers in terms of promoting their product quality, which in itself is an advantage for the supply to supermarkets – if peri-urban farmers can ensure regularity of product supply.

Linking research with local development

Research on urban agriculture requires a long-term involvement in the field because of its informal and unstable character. As urban farmers and traders are generally poor, it is not so easy to collect data from them without rewarding them in return, and it is not always easy to convince them of the long-term benefits of research on the economics of urban farming. At present, the literature on urban agriculture can be schematically categorised in two groups: the works of scholars – especially geographers and more recently economists who try to develop a scientific approach on urban agriculture with explicit research questions and hypotheses, often involving Masters or PhD. students who may have difficulties in gaining continuous reliable data in the field - and the work of practitioners, who are very much involved in the field where try to solve constraints of urban producers through stakeholders' platforms, technical or marketing support – but who may lack the time and skills necessary to carry out rigorous research to evaluate the socio-economic impact of UA and of the innovations in UA. Ideally, teams working on the development of UA should involve people from both research and development (and other stakeholders), be action-oriented and be more concerned with long-term replicability and impact of their work than with one-off assessments which could cause frustration for the UA farmers and for the research community alike. The Cities for the Future Programme of RUAF is seeking to establish working groups in the cities they are working in.

Table 7.6 *Summary of indicators of UA social and economic impact*

Level of Analysis	Household	City
Income Generation	Income per head of the different types of farmers and traders involved (compared with: subsistence income; alternative occupation; rural incomes) Income per ha, income per labour unit, and income per capital invested of the different types of farmers involved (compared with alternative use	Number of farmers involved in UA of the different socio-economic types Number of traders (and other input-provision and post-harvest enterprises) involved in the marketing of UA of the different socio-economic types Total incomes of and added values to the different stakeholders (farmers, traders, and related enterprises)
Food supply (Subsistence)	Share of self-consumption	Share of self-consumption in total urban consumption, for the different food products, and different socio-economic profiles (including the poor)
Food supply (commerial)		Share of intra-urban and peri-urban areas in the quantities of retail marketing for different food products: based on surveys on quantities/origin in selected wholesale and retail markets
Landscape and environmental preservation	Qualitative appreciation of UA for greening and environmental functions by non farmers Willingness to pay for UA preservation by urban residents	Combination of household based data Urban stakeholder groups' appreciation of UA environmental advantages/drawbacks Use of compost for UA and savings in transport of waste
Social inclusion	Appreciation of "self-esteem" provided by urban agriculture	Number of unprivileged urban residents (migrants, former unemployed) involved in UA

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Economic Impacts of Urban Agriculture in Peri-urban Beijing

Jianming Cai
Zhenshan Yang

In a rapidly changing city like Beijing, urban agriculture covers a diversity of (economic) roles. Not only does agricultural production benefit the producers and consumers directly, it also contributes to city growth and sustainable development.

Who Benefits

Cai Gaojian

Migrants in Beijing usually sell their vegetables by themselves along the road.

Beijing, the capital of China, is facing rapid urbanisation, and undergoing a dramatic transformation. Nearly all activities related to production are moving away from the city centre towards the periphery (the periurban areas). The backbone of the economy is changing, with a dramatic increase of the services sector and a decrease in the importance of the primary industry. This change can also be seen in agriculture. However, the role of agriculture would diminish and its functions in the city economy would depreciate, unless the city of Beijing takes measures to link agricultural activities to the city's development. Many farmers have become farmer entrepreneurs engaging themselves in urban agricultural production and management. Vendors sell urban agricultural products in the streets.

There are at least 2 million urban farmers in Beijing, including migrant farmers. According to official statistics, there were 3.2 million people living in the rural areas of Beijing in 2003, accounting for about 23 percent of its total population. Among this rural population, about 1.7 million are still classified as farmers, involved in farming, forestry, animal husbandry, fisheries, small industries and other commercial activities. Many of the rural youngsters are already full-time industry workers.

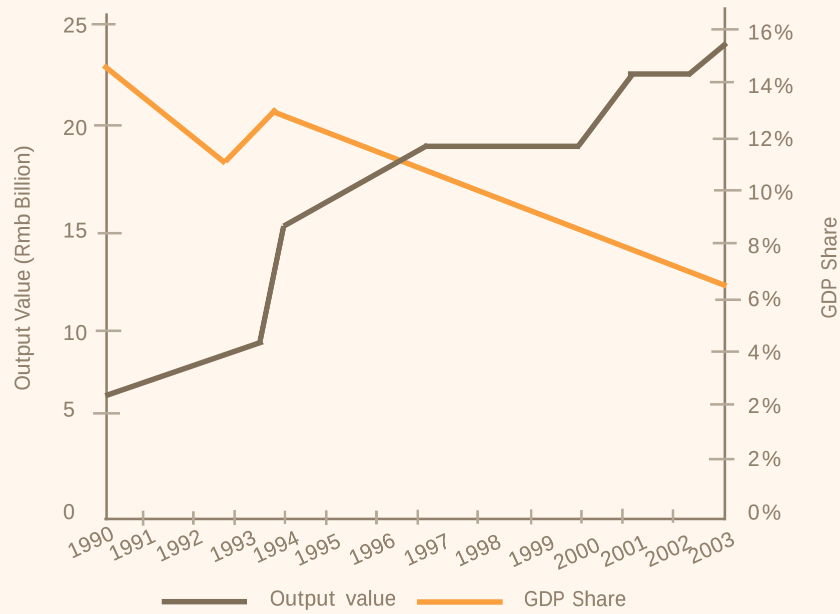
Meanwhile, more and more migrants arrive in Beijing, and join the ranks of the so-called "floating population". They come from all over China but have not yet got their household registration status in the city, even though they may have already lived in the city for many years. This situation is changing, but there are still many differences between the floating and local (registered) urban population. The peri-urban areas provide an opportunity for some of this floating population to engage in urban agriculture. This floating population amounted to approximately 4.1 million in 2003 in Beijing, of which about 55.9 percent and 35 precent lived in the inner and outer peri-urban areas respectively. According to author's research, the floating population in peri-urban Beijing increased by 350,000 from 2002 to 2003, with most of these people engaged in UA activities such as agro-tourism and processing of agricultural products.

In general, the economic impact of urban agriculture is multi-faceted, as is shown in the following analysis of three aspects: general city development, UA enterprises growth and farmer household benefit.

General City Development

In 1994, the municipal government officially launched its urban agriculture policy, which focused on six type of agricultural activities, i.e. promoting greenhouse farming, utilising new types of seeds, creating new brands of agri-products, agri-product processing, export agriculture and recreational (sightseeing) agriculture. Since then, Beijing has made notable achievements in its peri-urban development. The agricultural output value has been increasing steadily, but its share in the city's GDP has been declining (see figure 7.3).

Figure 7.3 *Agricultural Output Value and Its Contribution to GDP*



Source: Beijing Statistical Yearbook 2004.

The percentages of the rural population and agricultural land in Beijing have also got smaller during 1995-2003 (see table 7.8). Yet the output value of agriculture has gained a steady growth. In 2003, the agricultural output value per rural labour unit was RMB 37,554 (equivalent to US$ 4,700), while if other related activities such as rural industries and services are included, the rural gross output value per rural labour unit can be as high as RMB 96,018 (equivalent to US$ 12,000).

The economic structure in peri-urban Beijing has also been changing. Grain and vegetable production used to be the dominate sources of rural income in the 1980s. With the official introduction of urban agriculture in the 1990s, the agricultural economic structure changed dramatically. In 1995, the proportion of agricultural output value for farming, forestry, animal husbandry and the fisheries was 53 percent, 2 percent, 42 percent, and 4 percent respectively, and changed to 37.7 percent, 5.6 percent, 53.3 percent and 4.4 percent respectively in 2003. The market mechanism clearly played a role in this change. Other agricultural related industries also grew, diversifying the agricultural sector even more.

UA is strongly linked to other activities such as transport, construction, commerce and food catering. In fact, the number of agriculture-related labourers in peri-urban Beijing increased from 1,636,000 in 1995 to1,696,000 in 2003, despite the fact that urban Beijing expanded dramatically in this period and the agricultural land reduced. Most of this increase in work is in UA-related sectors such as agro-services, transportation and agro-business.

Table 7.7 *City growth and agricultural transformation in Beijing*

	Urban development		Agricultural Transformation		
	Urbanization level (%)	**City total population (million)**	**Rural population (million)**	**Arable land (1,000/ha)**	**Agricultural output value (Rmb billion)**
1990	62.0	11.03	4.2	412.7	7.0
1995	65.1	11.70	4.1	394.3	16.5
2000	77.6	13.80	3.1	329.2	19.5
2003	79.1	14.56	3.0	259.9	23.8
2020 (planned)	90.0	18.00	1.8	Na	Na

Source: Beijing Statistical Yearbook 2004. Beijing Municipal Planning Revision (2004-2020, unpublished)

Recent development trends show that urban agriculture in peri-urban Beijing is diversifying both in quantity and quality. In the inner peri-urban areas, more high-level and capital-intensive UA activities, such as agro-tourism, are growing fast, while in outer peri-urban areas, fruit growing and green vegetable production is taking place instead of traditional grain production.

Urban Agricultural Enterprises

In Beijing, the most common urban agriculture-related enterprises are processing and production, agricultural tourism and high-tech agriculture. Apart from mini- and micro-enterprises, there are also some big enterprises engaged in these activities In agricultural production and processing alone, over 940 enterprises are active (statistics of 2005).

From 2000 onwards, agro-tourism has gained momentum, including “sightseeing agriculture” which refers to one-day trips of tourists (visiting and picking activities) and “recreational agriculture”, referring to multiple-day stays with accommodation and other tourism-related activities. Many farmers build up sightseeing agricultural gardens by utilising their existing farm land. These easy-access activities have resulted in more than 1,900 sightseeing agricultural gardens in the 300 villages of the 50 towns and townships in peri-urban Beijing. Among these gardens of varied size, there are 285 big enterprises, of which 30 are designed as municipal key gardens. At another level of agro-tourism, recreational resorts make use of resources by integrating agricultural activities with modern recreational experiences, hotels and entertainment. There are now about 155 different resorts in Beijing integrating services such as health care, ecological experiences, folk custom appreciation, etc.

Hi-tech agro-industry is another active area for UA related development in peri-urban Beijing. By the end of 2001, 375 various hi-tech agricultural parks had been constructed. The most famous is Xiaotangshan High Tech Demonstration Agricultural Park, which is a national level park. Besides this, there are six other hi-tech agricultural parks constructed by the Ministry of Chinese Technology & Science and 25 agro-industrial parks sponsored by the Beijing municipal government.

As illustrated in Table 7.8, UA enterprises in peri-urban areas are quite lucrative with a high income ratio. In fact, all UA related enterprises make more money than enterprises in other sectors, such as services and manufacturing. This was particularly true since 2002, when UA development in Beijing got a substantial boost through the promotion of the municipal government.

Table 7.8 *Income ratio of enterprises in peri-urban Beijing by sector*

	2000	2001	2002	2003
Agriculture	1.11	1.10	1.55	1.52
Woods and Forestry	1.10	1.10	1.62	1.53
Animal Husbandry	1.05	1.03	1.32	1.31
Fisheries	1.04	1.12	1.40	1.39
Manufacturing	1.15	1.14	1.20	1.20
Construction	1.12	1.12	1.20	0.12
Transportation	0.74	0.69	1.30	1.28
Wholesale & Retail Trade	1.12	1.06	1.15	1.14
Services	1.18	1.31	1.00	1.00

Note: The Ratio equals income divided by cost
Source: Beijing Statistical Yearbook 2001-2004

In terms of gross output value, the economic performance of UA is also quite outstanding, as shown in Table 7.9. For example, the annual growth rate of the gross output value for urban agriculture in processing and production is high at 26 percent during 1998-2002 (Beijing Agricultural Yearbook 2003). It can be foreseen that agricultural processing will become even a more important UA sector in peri-urban Beijing since the market potential in Beijing is huge. For the same reason, sightseeing and recreational agriculture will also have a promising future in peri-urban Beijing.

Table 7.9 *Economic performance of urban agricultural industry*

Types	Economic performance
Agro-processing and production	Growth rate in 1998-2002: 26 percent;; 68.1 percent of the total agricultural output value in 2002; output value in 2005: Rmb25 billion
Sightseeing Agriculture	Agro-tourists: 40 million person-times Revenue: Rmb2.7 billion in 2004
High-tech Agriculture	Output value: Rmb3.84 billion in 2001 Profit: Rmb1.66 billion in 2001 Accounted for 18 percent of the total Beijing's agricultural output in 2001

Source: Situation of agricultural processing in Beijing, 2003 (Jiuran, Zhao), Practices and explorations on high tech agricultural gardens in Beijing (Beijing Municipal Rural Commission, Beijing Fiscal Bureau & Beijing Rural Economic Research Center)

Farmer or Household Level

Urban agriculture definitely has a high economic impact on individual households, too, including that of local and migrant farmers. Farm workers in UA enterprises and urban farmers cultivating on rented plots (migrants) saw their incomes rise quickly in recent years.

According to research (Table 7.10), there were about 272,000 farm households who were involved in agro-processing activities in peri-urban Beijing in 2002 and received an income of RMB9,600 Yuan (equivalent to US$1,200) per capita, which was much higher than the average income of farmers in Beijing. In sightseeing and recreational agriculture, there were 24,000 farmer households involved, of which 20 percent were getting better-off.

Table 7.10 *Farmer households involved in UA in peri-urban Beijing*

Types	No. of farmer households involved in	Benefits
Agro-processing and production	272,000 (2002)	Income: RMB9,600 per capita Net income: RMB4,500 per capita, higher than average farmer net income in Beijing
Sightseeing Agriculture	24,000 (2004)	20 percent of the households are getting better off
High tech Agriculture	94,000 (2002)	Na
Rural association	342,000	about 80 percent of milk, 46 percent of vegetable, 35 percent of melons, and 30 percent of aquatic products in peri-urban Beijing are distributed through these associations

Li Jinshan. 2002.

There were 2,030 agricultural associations in peri-urban Beijing in 2002, with 342,000 households as members (from 500 villages). About 80 percent of milk, 46 percent of vegetable, 35 percent of melons, and 30 percent of aquatic products in peri-urban Beijing were distributed through these associations

For the floating population of farmers, the economic impact of UA is even greater. According to a case study done by the China Regional Focal Point of the RUAF programme in 2005 (Liu, Cai & Yang) , the net income of migrant farmers in peri-urban Beijing could be as high as RMB 8,000-9,000 Yuan (equivalent to more than US$ 1,000), which is more than five times the net income in their home villages. It was estimated that there were more than 100,000 migrant farmers in peri-urban Beijing in 2003, while this number is continuing to grow as the development of various types of UA activities in the city is accelerating.

Notes

[1] The basic theory on the relationship between transaction cost reduction and institutional arrangements was established by Williamson (1985). For applications in the horticultural sector, see Jaffee (1995), Lyon (2000), Moustier (1996).

[2] Multifunctionality is usually defined as the multiple roles or objectives that society assigns to agriculture, including economic, social and environmental roles. This “normative” definition has to be combined with a more constructivist approach which considers the synergy between the functions (Vollet, 2002; Véron, 2004).

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PROVE – Small Agricultural Production Verticalisation Programme

João Luiz Homem de Carvalho

PROVE – Small Agricultural Production Verticalisation[1] Programme - is a programme designed to promote small-scale agricultural production, processing and trade. It involves many urban and periurban agricultural systems, including vegetable gardening, fruit growing and livestock keeping. Intervention is at the individual and / or collective level, especially aimed at lower income groups.

PROVE started in 1995. In the five years prior to 1995, over 400,000 small farms were closed down in Brazil, forcing about 2 million people to leave the rural areas. This rural exodus played a major role in increasing the unemployment rate as the cities could not provide to jobs to so many people. Simultaneously, this increasing urbanisation has led to an increase in the demand for processed products. PROVE was designed to tackle both problems.

João Luiz Homem de

Dissemination activities began with a party to celebrate the

In the period of 1995-1998, under PROVE, about 500 small agro-industrial facilities were built in Brazil. During the said period, the monthly per capita family income of those involved in the programme rose from 25 to 100 dollars. On average, each project generates jobs for six people, who are usually members of the same family. The funds disbursed by the public sector (US$ 200) for each job that PROVE generates are related to expenses on wages, cars, fuel, etc. All the remaining costs are borne by the producers themselves.

The PROVE was designed to enable small farmers to overcome certain fundamental stages or hurdles in the production, processing, and trade of their products which in our opinion can segregate them. For illustrative purposes, these stages are compared to rungs in a ladder (11 rungs) that small farmers have a very hard time climbing (Carvalho 2001). Enabling them to climb these rungs is a fundamental requirement to ensure the success of the PROVE and, consequently, to ensure their social integration with sustainable development and solidarity.

1. Motivating institutions

The first step consists of an inventarisation and assessment of the stakeholders; how and for what purpose could the existing public institutions be engaged in a programme like PROVE? We ensured that the officials involved were provided with all the required information about the programme. Courses, presentations, and seminars on the need to work with socially-marginalised rural producers were used for this purpose. The political will of the government as a whole to carry out the programme was also clearly demonstrated to them. The priority was on disseminating information about the programme.

2. Providing incentives

In order to motivate a socially-marginalised audience, the advantages of the programme were described. This meant explaining the added value to small rural production schemes and collective initiatives, without closing the doors to others who wished to take part in the programme individually. The producers were encouraged to create the Association of PROVE

Producers. Furthermore, the NGO APROVE (Association in Support of Small Agricultural Production Verticalisation) was established for the purpose of supporting and encouraging small farmers' initiatives.

3. Ensuring credit lines

Credit lines were provided, both by public and private finance agents, at market interest. A Guarantee Fund created by the public sector is used to guarantee loans of up to US$ 7,000 for individual projects, and US$ 25,000 for collective projects. For loans above these limits, the borrowers have to provide collateral. The grace period for repayment to each project varies according to the financial capacity of each borrower, but it typically ranges from 1 to 2 years for an individual and 4 to 6 years for collective projects. The mobile agro-industrial scheme itself is the guarantee for the bank. The idea for this scheme arose from the need to consider people who, despite having their credit applications turned down, were competent enough to generate an income and jobs. After all, like anyone else, they need to work, raise children, and lead a meaningful life.

João Luiz Homem de Carvalho

A mobile agro-industrial facility arriving at the Luz municipality, state of Munas Gerais

4. Specific sanitary legislation and laws

It was necessary to review and reformulate the Law of the Federal District for the Inspection of Animal and Vegetal Products, as it was a hurdle for many people to engage in such activities. The state government drafted a set of rules for the construction of small agro-industrial facilities (30-40 m^2) and enacted them into law. This law has served as an example for other Brazilian states and cities.

5. Building small agro-industrial facilities

Once the law was passed, projects for small agro-industrial facilities such as slaughterhouses for small and medium-sized animals and facilities for producing sweets, pre-processed vegetables, preserves, dairy products, etc. were developed.

6. Training

Training was provided to small producers for starting the production of raw materials. Visits were paid to supermarkets to provide them with theoretical and practical guidance on how to market processed or semi-processed products. Courses on the establishment of associations and cooperatives, and rural management, food hygiene and handling, specially designed for PROVE target audiences, were provided.

7. Inputs

Various inputs are necessary for manufacturing different products. In addition, packaging of the processed products determines the success of marketing. Small-scale producers do not always have enough funds to buy all these inputs. For this reason, the Small Agro-Industry Counter was created to enable small producers to buy small-sized machines and equipment.

8. Publicity and marketing

PROVE wanted the government to stimulate and fund publicity and marketing professionals on a full-time basis for designing and implementing a plan for the marketing of its products. One of the most important tasks was to create a trademark identifying the programme (PROVE means "taste it" in Portuguese) which covers all products. It also serves as a quality seal.

9. Trading the products

The small agro-industrial facilities make many products of excellent quality. Marketing of the products is the endpoint of the production process, which is also the most difficult stage. PROVE has shown that it is much easier to sell a good product with an attractive packaging and a professional label, even if it is manufactured at a small scale and by low-income people. PROVE products began to be sold in supermarkets as a result of an agreement between the states, supermarkets and producers (Pesquisa PROVE - Market Research 1998).


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The producer kiosk of PROVE in a supermarket

10. Inspection and control

For consumers to be assured of the hygienic and sanitary conditions of PROVE products, they must know that they are inspected at the production site and are subject to strict quality control measures. For this purpose, chemical and microbiological analyses are carried out on the products, which are periodically inspected.

11. Follow-up

The information collected during the evaluation of PROVE (Duarte et al. 1998), showed that the programme contains the necessary elements to sustain its success - those of including small farmers in the production system and restoring their citizenship rights. The fact that small producers in the PROVE programme have developed the skills to manage their own businesses, understand the cost-benefit calculations of their activities, keep accounts and plan for the future clearly indicates the changes that have taken place in the lives of these people. The excellent ratings on transferability of the programme can mainly be attributed to the massive dissemination campaigns through the national media and to the thousands of site visits paid by people coming from different parts of Brazil and abroad to the capital, Brasilia. These people have confirmed that the programme is feasible, particularly because it can be implemented easily and at a low cost for public agencies, while also boosting the local economy.

Why PROVE did not continue in the Federal District

Despite the development and success of PROVE in the Federal District Brasilia for four years (1995-98), the creation of enabling bylaws, and the success of the programme in other regions in Brazil, the programme came to a halt in the Federal District of Brasilia.

The main reason is that the programme did not manage to create sustainable institutional structures, owned by the social actors involved (government, micro-entrepreneurs, University). It was therefore vulnerable to political changes.

With the change of government in 1999 in Brasilia District, the existing links between producers / micro-entrepreneurs and the government were broken. It appeared that the Association of PROVE producers (ASPROVE) still was too dependent on support by Government and could not survive by its self. In 2003, most agro-industries had stopped functioning or continued functioning marginally.

Of course in setting up programmes for the poor and excluded population one cannot expect them to be autonomous in just 4 years. There is a need for prolonged government support for the most vulnerable sector of society. What happened was, that the PROVE programme from the start was only supported by the then dominant ruling party, “the Workers Party”, and never counted with support from opposition. A major lesson is thus, that one should try to involve and assure the support of all political parties when setting up this kind of programmes and in formulating a new enabling policy framework. This makes the programme less vulnerable to change of government.

In addition, support to poor producers should not only focus on technical production and marketing aspects. Education, capacity building and support in leadership, political lobbying, organisation and financial management is just as important to limit vulnerability and dependency on external support.

Note

[1] The strong involvement of farmers, or their relatives, in the processing and marketing of their products, can be termed as vertical integration or "verticalisation" when directly translated from Portuguese.

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Income Generated by Farming Systems in and around Kumasi

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Market proximity is a major incentive for the intensification of farming systems or change of systems to more profitable ones. A common example of such intensification is the production of perishable products, such as vegetables, in urban and periurban areas. Around Kumasi, many rain-fed maize-cassava farmers have started dry-season vegetable production along streams to generate additional income, while in the city itself, year-round open-space vegetable production is common, especially in bottomlands with access to water for irrigation. These systems are not only output intensive - with for example up to 11 lettuce harvests per year - but also manage to overcome shifting cultivation by farming on the same plot nearly continuously, despite often marginal soil quality. This is only possible through high inputs of manure, water, labour and skills (Drechsel *et al.* 2005). The motivation to start urban vegetable farming in Kumasi, despite the higher risk and dependency on in- and output market fluctuations, is largely economic.

IWMI Ghana

Farmers in Kumasi apply poultry manure to cabbage

Kumasi is the capital town of the Ashanti Region and the second largest city in Ghana, with a population of about 1,017,000. Kumasi has a semi-humid tropical climate with an average annual rainfall of 1,488 mm. The periurban area of Kumasi extends on average to 40 km from the city centre (Adam 2001). Urban vegetable farmers in Kumasi have informal land arrangements with the authorities or private owners and do not pay rent on the land. This is done in some cases in order to keep these areas clean and to prevent encroachment by squatters. Periurban or rural farmers, on the other hand, hold short-term (eg. two year) renting or leasing agreements with the chiefs of their communities for traditional maize-cassava intercropping.

The major crops cultivated by urban vegetable farmers are lettuce (9-11 harvests / year), cabbage (2-3 harvests / year), spring onions (8-9 harvests / year), as well as "Ayoyo" (*Corchorus sp.)*, "Alefi" (*Amaranths sp.),* carrots, radish and cauliflower. Urban vegetable farmers cultivate all of these crops year-round, mostly with manual irrigation, and vary crops according to their own specialisation and the market demand. In periurban Kumasi, farmers still rely on traditional and largely subsistence maize and cassava rain-fed farming. Close to streams or where shallow wells can be dug, many of them take up dry-season cultivation of, for example, okra, tomatoes, peppers and cabbage for the urban market. Besides access to water, dry season vegetable production depends on a good road network.

Surveys carried out by the Kwame Nkrumah University of Science and Technology (KNUST) with the International Water Management Institute (IWMI) as well as different British research teams have covered about 300 farm households in total. Cost-benefit analysis comparisons were made of farm finances of common rural, periurban and urban farming systems (i.e., traditional maize-cassava farming, additional dry-season vegetable growing with irrigation, and open-space year-round urban vegetable farming).

Urban and periurban farmers use water from streams, drains and dugout wells, and in a few cases pipe-borne water. In the urban areas, farmers use watering cans, whilst periurban farmers often use pumping machines or carry water from streams to their farms. Manual irrigation needs to be carried out frequently and as such makes irrigation time-consuming and expensive (13 percent of total cost – excluding family labour – and 38 percent of time spent). Only weeding was rated as more expensive by the farmers (23 percent of total cost). The cost of hiring pumps is estimated to be from US $40-70 per dry season (ca. 3 months). Most farmers who use manual labour rarely pay for it as they depend on family labour, though occasionally they hire labourers, rarely paying more than US $11 per season. In general, manual labour is more expensive per volume of water delivered (US $3-6 per m^3) as compared to the use of pumps (US $0.6-5 per m^3) (Cornish *et al.* 2001).


IWMI Ghana

Irrigation of Urban Vegetables in Accra

Besides water, vegetable farmers also use significant amounts of different types of nutrient inputs as well as pesticides. In Kumasi, the use of poultry manure is very common due to its high availability and low price (US $0.1 per sack). Only a few farmers use mineral fertilisers in addition to this (mostly for cabbage). In periurban Kumasi, many more vegetable farmers use mineral fertilisers (US $14 per 50kg NPK) but combine it with poultry manure when possible.

In periurban Kumasi, women and men play similar roles in crop production while urban vegetable farming is mostly done by men. Women, however, play a major role in crop marketing in both urban and periurban areas. Traders usually purchase vegetables at the farm gate. Prices vary significantly from one season to another. Occasionally, traders provide farmers with inputs (especially seeds) in order to get them to produce the type of crops needed for sale.

In the study area, vegetable farming is done for income generation. This applies especially to those farmers growing exotic vegetables, while farmers specialized on traditional ones might also consume 20 percent of their harvest. Urban farmers occupying open space in low- or bottomlands crop all year round and attain annual income levels of US $400 to $800 (see Table 7.11); this is 2-3 times the income they could earn from rural farming. However, being successful in this type of farming requires careful observation of market demand. As urban farming is land and labour constrained, the typical farm size is around 0.1 ha. Urban farmers thus earn at least twice as much as rural farmers on only about 20 percent of the farm area.

For periurban farmers, dry season vegetable farming with irrigation can add a significant amount of cash to their income; especially as large parts of their rain-fed maize and cassava harvest are used for household consumption. Without this additional income, cash availability might actually be less than US $100 per year. However, only a minority of periurban farmers shift to year-round vegetable farming (eg. tomatoes in the Akumadan area). There are three reasons for this: the importance of maize and cassava for home consumption (mentioned by 52 percent of the farmers interviewed); the lower price of vegetables in the rainy season (40 percent); and the increased risk of pest attacks (8 percent).

Irrigated vegetable production is not only a way out of shifting cultivation but also out of poverty. Where vegetable marketing is possible, periurban and especially urban vegetable farmers make a significant step over the poverty line.

Table 7.11 *Revenue generated in different farming systems per ha (Danso et al., 2002)*

Location	Farming system	Typical farm size (ha)	Net revenue (US$) ha/year	Net revenue US$)/ farm/holding/year
Rural/ PUA	Rain-fed maize or maize/cassava farming	0.5-0.9	350-550	200-450
PUA	Dry season vegetable farming; irrigation only	0.4-0.6	300-350	140-170
PUA	Dry-season, irrigated vegetables and rain-fed maize (or vegetables)	0.7-1.3	500-700	300-500
UA	Year-round irrigated vegetable farming (lettuce, cabbage, onions)	0.1-0.2	2,000-8,000	400-800

These are typical values; subsistence production has been converted to market values.
PUA= peri-urban agriculture; UA= urban agriculture

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Resources

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www.avrdc.org/susper/
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www.cipotato.org/urbanharvest/home.htm
In late 1999 the CGIAR launched a system-wide initiative to direct and coordinate the collective knowledge and technologies of the Future Harvest Centers towards strengthening urban and peri-urban agriculture. The Initiative, formerly known by its acronym SIUPA, but renamed Urban Harvest has been involved supporting and implementing research and development projects in regional settings, as well as in alliance-building initiatives at global and regional level.

Chapter 8

Recycling of Urban Organic Waste for Urban Agriculture

Sustainable management of solid waste is a major challenge being faced by municipal authorities across the world, both in the North and the South. In developing countries, urban waste remains a serious problem that causes contamination of soil and water bodies and endangers human health and the environment. Much of the solid waste consists of organic matter that can be recycled into a profitable input (compost) for urban agriculture. Composting the large quantities of organic matter provides a win-win strategy by reducing waste flows, enhancing soil properties, recycling valuable soil nutrients and creating livelihoods, but there remain several constraints that explain why this opportunity is seldom exploited. This chapter discusses the benefits of constraints to composting and presents a framework for analysis and planning of composting interventions. The arguments and models contained in the chapter are supported with case study material from Ghana, Philippines and Kenya.

Recycling of Urban Organic Waste for Urban Agriculture

Olufunke Cofie
A. Adam-Bradford
Pay Drechsel

The Urban Waste Challenge


A. Adam-Bradford

Block-built triple chamber compost bin being used at Apeadu Junior Secondary School, Kumasi

The accelerated growth of the global urban population implies an increasing demand for public services. Yet, urban centres in developing countries are unable to meet such demand – services such as sanitation are poor or inadequate to cope with the increasing rates of urbanisation and the associated higher standards of living. According to the UN 2002 Human Development Report, 2.4 billion people in the developing world lack access to basic sanitation. In Africa, Asia and Latin America, the sustainable management of waste is a major challenge for municipal authorities. Waste is a product or material that does not have a value anymore for the first user and is therefore thrown away; however, it could have value for another person in a different circumstance or even in a different culture (van de Klundert and Anschutz, 2001). Municipal authorities have insufficient financial, technical, and institutional capacities to collect, transport, and safely treat and dispose of municipal wastes, consequently waste management remains one of the major urban problems (Drechsel and Kunze, 2001). In Ghana for example, 58 percent of the solid waste (SW) generated is dumped by households in designated dumping sites, 25 percent is dumped elsewhere in non-designated sites, and only 5 percent is actually collected. The quantity uncollected varies from place to place and could be as high as 20 percent as in the two largest cities of Accra and Kumasi. (GSS, 2000). The situation in other African cities is hardly different. In many cities household waste collection is restricted to wealthy neighbourhoods, while in the remaining areas waste is dumped along road sides, in illegal dumps and in storm water drains (Mbuyi, 1989). The city authorities in Tanzania collect only 24 percent of the refuse (Kulaba, 1989) while in Nigeria, 35 percent of Ibadan's households, 33 percent of Kaduna's, and 44 percent of Enugu's do not have access to waste collection. (Asomani-Boateng and Haight). In Ougadougou, Burkina Faso, about 23 percent of household wastes are deposited in small drains (Ousseynou, 2000). In India, about 50 percent of the refuse generated is collected. As much as 90 percent of the Municipal Solid Waste (MSW) collected in Asian cities end up in open dumps. (Medina, 2002). The failure of city authorities to collect waste leads to unpleasant conditions and decomposing wastes constitute a serious health and environmental hazard (Ali, 2004)

Urban waste could be solid or liquid, organic or inorganic, recyclable or non-recyclable. A considerable quantity of urban waste is biodegradable and hence of immediate interest in recycling (see Box 8.1).

Very large quantities of SW are generated in urban areas; the average SW generation is 0.6 kg per person per day. Based on the composition of solid waste of cities of low- and middle income countries (from Algiers, Alexandria, Cairo, Sao Paolo, Obeng and Wright, 1987), easily bio-degradable fractions range between 44 percent and 87 percent in weight (see Figure 8.1). Similar ranges (40-85 percent) are also reported by Cointreau et al. (1985) for low-income countries. Levels of urbanisation and modernisation have a profound effect on the production and composition of municipal waste; however, some general trends such as the high content of organic matter (50-90 percent) provide an opportunity for exploitation through composting processes (Allison et al., 1998; Asomani-Boateng and Haight, 1999). The percentages of organic matter in municipal solid waste in selected African cities were recorded as 56 percent in Ibadan, 75 percent in Kampala, 85 percent in Accra, 94 percent in Kigali and 51 percent in Nairobi (Asomani-Boateng and Haight, 1999). The volume and composition may however be subject to large seasonal variations (GFA-Umwelt, 1999). A detailed report on the organic waste flow in integrated sustainable waste management has been written by Dulac (2001). In short, the waste stream is not a homogenous mass but a collection of different materials (organic material, plastics, metal, textiles etc.) that can be handled in different ways to maximise recovery. The organic waste fraction remains the largest proportion to be recovered.

Box 8.1 *Common forms of organic waste*

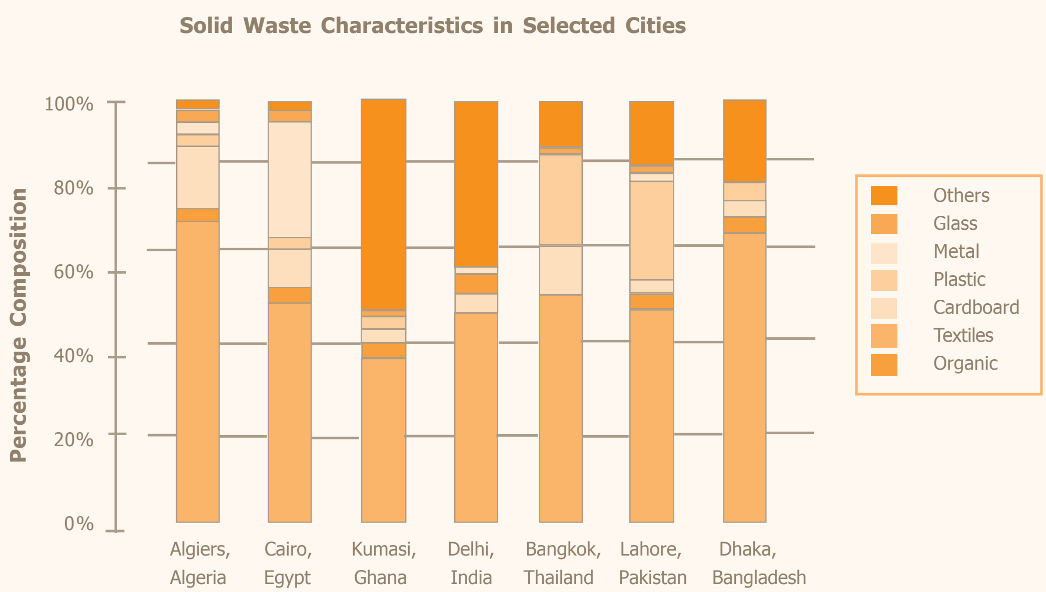
Solid waste: domestic and market wastes, food waste including vegetable and fruit peelings, charcoal ash. This also includes waste from institutions and commercial centres.

Horticultural and agricultural waste: garden refuse**,** leaf litter, cut grass, tree prunings, weeds, animal dung, crop residues, waste from public parks etc. Manure: poultry, pig, cow.

Agro-industrial waste: waste generated by abattoirs, breweries, processing and agro-based industries

Sludge and bio-solid: human faecal matter from septic tanks and treatment plants

Figure 8.1 *Solid Waste characteristics in selected cities (Drawn using data from: Hughes, 1986; Obeng and Wright, 1987; WASTE 1997; Zurbrügg, 2003; Ali, 2004)*



Urban Waste Management Strategy

Many approaches to waste management exist. Generally, solid waste is managed through landfills, incineration and recycling or reuse. However in developing countries, properly engineered landfills are not common while the cost of modern incineration is too exorbitant to bear. Hence, the most common method of waste disposal is some form of landfill, including variants such as uncontrolled dumping in undefined areas, collection and disposal on unmanaged open dumps, collection/disposal on controlled dumpsites (UNEP, 2004). It is common to find scavengers moving from door to door or sorting through communal bins to pick dry recyclable materials. However, these pickers are more interested in inorganic recyclable materials such as plastics and glass, but not in organic wastes.

Agenda 21, adopted in Rio in 1992, states that environmentally sound waste management should include safer disposal or recovery of waste and changes to a more sustainable pattern introducing integrated life cycle management concepts (UNEP, 2004). It introduced a step-wise approach to waste management in order of environmental priority. The general principle of the waste management hierarchy consists of the following steps:

- Minimising wastes;
- Maximising environmentally sound waste reuse and recycling;
- Promoting environmentally sound waste disposal and treatment;
- Extending waste service coverage.

After Rio most countries have generally accepted this hierarchy as a strategy towards an environmentally sound waste management system. In the last ten years the concept of Integrated Waste Management (IWM) has evolved and is slowly becoming accepted by decision makers (UNEP 2004). IWM relies on a number of approaches to manage waste, including all aspects of waste management, from generation to disposal, and all stages in between with proper consideration of technical, cultural, social, economic and environmental factors. Resource recovery is critical and is embedded in this strategy.

Recycling of Urban Organic Waste

Current urban organic waste recycling practices include the following:

- The use of fresh waste from vegetable markets, restaurants and hotels, as well as food processing industries as feed for urban livestock (Allison et al. 1998);
- Direct application of solid waste on and into the soil;
- Mining of old waste dumps for application as fertiliser on farmland (Lardinois and van de Klundert, 1993);
- Application of animal manure such as poultry/pig manure and cow dung;
- Direct application or human excreta or bio-solids to the soil (Cofie et al., 2005)
- Organised composting of SW or co-composting of SW with animal manure or human excreta.

Whichever method is used, a process of microbial degradation releases the useful nutrients in organic waste for soil improvement and plant growth. Composting is the process of decomposing or breaking down organic waste materials (by micro-organisms such as bacteria, protozoans, fungi, invertebrates) into a valuable resource called compost. Composting is done at different scales (large, medium, small) by various people (municipalities, NGOs, communities, individuals) and for various purposes (gardening, landscaping, farming) in the urban areas. In the 1970s, large scale centralised composting was prominent especially in the Western world. However, this has proved to be a failure (Onibokun, 1999). The collection and transportation of organic waste to centrally managed sites is expensive, time consuming and energy intensive; these processes are also dependent on fossil fuel inputs that are often heavily subsidised in order to enable maintenance of fuel inputs, therefore extending economic inefficiency at the macro-level. In situations where funding is secured from donor agencies, the conditions accompanying such funds are often disincentives to good practice. Technological know-how on financial analysis, engineering design of composting facilities and transport schedule modelling has been very limited in developing countries (Cointreau-Levine, 1997). In addition, technological transfers of composting processes and equipment from developed countries were often done in the past without considering local constraints (Hoornweg et al., 1999; Etuah-Jackson et al., 2001) and the technologies transferred were often not applicable in the receiving country. Also comprehensively planned composting stations, based on a demand-supply analysis, are not common. In fact, waste management authorities in many developing countries hardly have the "luxury" of planning for recycling; instead they focus their limited resources on the priority needs of "waste collection" and "safe disposal" which consume an immense share of the municipal budgets in low-income countries as cost recovery is low (Drechsel et al., 2004). The irony is that if well planned, the costs of waste disposal could be reduced through composting. However, what appears to be a logical win-win- situation for city authorities and farmers, is seldom a reality in the developing world (see the case study by Duran et al on Marilao, Philippines, for an example of an innovative win-win solution). This is due to several factors such as lack of affordable equipment, technical personnel, frequent mechanical breakdowns, and financial restrictions (Drechsel et al., 2004; Asomani-Boateng et al., 1996).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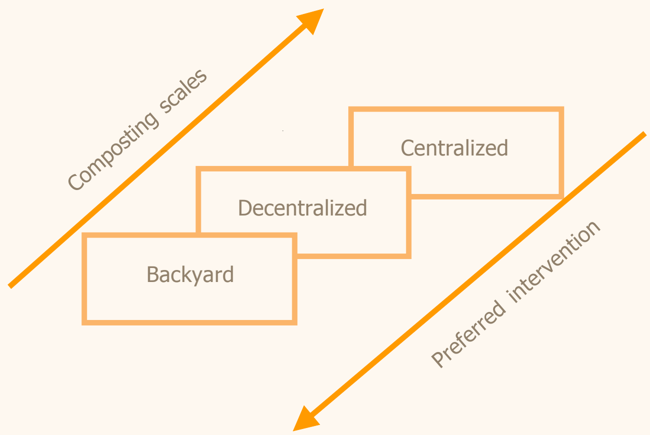
Waste ready for collection

In the 1990s, small to medium scale decentralised composting based initiatives evolved (eg. see GFA-Umwelt, 1999). However, a transition from centralised composting to decentralised composting approaches is often compounded by the lack of inter-sectoral planning (waste/planning/agriculture) in waste management. Ecological approaches to waste management have only been adopted where predominant conventional waste management approaches are not challenged. Consequently, small-scale decentralised approaches are yet to receive extensive government support at national levels. Cuba is a marked exception to this general pattern in urban planning and management. In the very different geopolitical and social conditions of Havana, Cuba, substantial progress has been made in recycling urban organic waste, as nutrient recycling principles have been implemented in practice and have proven to be very successful (Cruz and Medina, 2003; Díaz and Harris, 2005; Viljoen and Howe, 2005). But generally on a global scale, at the lowest intervention level, backyard composting is practised by few individuals.

By far, the better composting options are those that are decentralised and use organic waste as close to the source as possible. Decentralised on-site (for commercial organic waste) and on-plot (for domestic organic waste) are the preferred levels of intervention with each individual intervention requiring the appropriate technology at the appropriate scale In essence, the primary function is all about getting the nutrients and organic matter in waste back into the soil in the most efficient and effective manner; hence the priority order of backyard composting (household) and decentralised (community) approaches (see Figure 8.2). Centralised municipal approaches do not have a good track record and the potential scale-of-economy advantages have not materialised due to operational and marketing constraints.

Figure 8.2 *Composting scales of intervention*



Source: Bradford, 2005

Use of Urban Organic Waste for Urban Agriculture

The provision of sufficient food and the provision of basic sanitation services, two major challenges in (mega-)cities, are inter-linked as the urban food supply contributes significantly to the generation of urban waste (Drechsel and Kunze, 2001). In principle, therefore, recycling organic waste through composting could be a win-win situation for municipalities and farmers (for example see the Marilao, Philippines case study by Duran et al.). The interests of urban waste recycling go well with the promotion of urban agriculture since urban and peri-urban farmers are in need of organic matter as a soil conditioner. Cities and towns, on the other hand, wish to conserve disposal space and reduce the costs of landfills as well as municipal solid waste management. Also important is the need to incorporate informal waste collectors and the private sector that contribute to urban waste management into this process (see Box 8.2 and the Nairobi, Kenya case study by Njenga and Karanja).

Benefits and constraints

Zurbrugg and Drescher (2002) report that the potential benefits of organic waste recycling are particularly in reducing the environmental impact of disposal sites, in extending existing landfill capacity, in replenishing the soil humus layer and in minimising waste quantity. Other benefits adapted and summarised from Hoornweg et al. (1999) with particular reference to organic waste composting are that it:

- increases overall waste diversion from final disposal, especially since as much as 80 percent of the waste stream in low- and middle-income countries can be composted;
- enhances recycling and incineration operations by removing organic matter from the waste stream;
- produces a valuable soil amendment - integral to sustainable agriculture;
- promotes environmentally-sound practices, such as the reduction of methane generation at landfills;
- enhances the effectiveness of fertilizer application;
- can reduce waste transportation requirements;
- is flexible for implementation at different levels, from household efforts to large-scale centralised facilities;

- can be started with very little capital and operating costs;
- the climate of many developing countries is optimum for composting;
- addresses significant health impacts resulting from organic waste such as reducing Dengue Fever;
- provides an excellent opportunity to improve a city's overall waste collection programme;
- accommodates seasonal waste fluctuations such as leaf litter and crop residues;
- can integrate existing informal sectors involved in the collection, separation and recycling of wastes.

Box 8.2 *Solid waste and urban and peri-urban agriculture in Bamako, Mali*

Urban waste produced in Sahelian cities has been providing a source of nutrients and organic material for farmers in the peri-urban interface for quite some time. In Bamako, current developments present interesting opportunities for ensuring a safer and more sustainable recycling of solid urban waste.
In the peri-urban zone of Bamako, farmers involved in mixed cereal and horticultural crop farming prefer to use the solid waste primarily on their staple crops and are prepared to pay for it. The form and manner in which waste is applied is also more appropriate for cereal crops than for the relatively intensive cultivation methods used for vegetables and strawberries, particularly with respect to soil management. In this sense, urban waste is a second-choice product as a soil improver/fertilizer for horticulturalists. But given the relative scarcity of the preferred animal manure, there remains a demand from this group of farmers.

Cultivation on degraded soils has even been revived in some cases due to this readily available resource. However, uncertain land tenure means that farmers have little incentive to ensure the safe disposal of dangerous elements in solid waste. Current plans would eliminate this recycling practice and promote large-scale composting, but the cost for farmers will be too high, leaving them with an incentive to make their own illicit arrangements for acquiring waste material. Furthermore, small enterprises and associations that have come to play a complementary and innovative role in waste management would be forced out.

The key challenge for policy is to regard urban waste not as a dangerous nuisance but as a source of nutrients and organic matter in agriculture, provided that a system for separating dangerous wastes is in place. The master plan is not yet finalised in Bamako, and local actors seem convinced that pilot initiatives as undertaken in the peri-urban areas will be integrated in the plan. The experience in Bamako indicates the value of some form of new stakeholder platform that addresses these linkages in a more concrete manner by working at the more local level of the communes rather than that of the entire municipality (district of Bamako).

Source: Eaton and Hillhorst, 2003

Although composting seems an attractive option in many respects, it is also constrained (Hoornweg et al., 1999) by the following factors:

- Inadequate attention to the biological process requirements;
- Over-emphasis placed on mechanised processes rather than labour-intensive operations;
- Lack of vision and marketing plans for the final product - compost;
- Poor feed stock which yields poor quality finished compost, for example when contaminated by heavy metals;
- Poor accounting practices which neglect that the economics of composting rely on externalities, such as reduced soil erosion, water contamination, climate change, and avoided disposal costs;
- Difficulties in securing finances since the revenue generated from the sale of compost will rarely cover processing, transportation and application costs.

An evaluation of composting projects in West Africa pointed out that apart from being too expensive, a common problem leading to project failure is poor *co-ordination* among institutions and stakeholders due to weak institutional linkages and the lack of an enabling institutional framework, including clear legislation and policies. Experiences from six composting stations of different scales of production in five countries in West-Africa (see the overview in table 8.1 in the Annex) showed that compost stations in the sub-region suffer from a number of omissions (Drechsel et al., 2005). Lack of thorough market analysis including consideration of alternative soil inputs; transport costs; user's demand as well as willingness and ability to pay for compost prior to station set-up; lack of supportive legal frameworks and institutional arrangement to implement composting initiatives are some of these. In many cases, important stakeholders (land owners, waste collectors etc) were often not involved in planning which then constrained successful implementation. Apart from these, most composting projects are not financially viable, especially when outside funding available for the initial set up is exhausted. These points confirm the need for a comprehensive feasibility study before setting up any composting project.

Framework for Analysis and Planning of Composting

Planning is necessary to ensure a well functioning composting system. Analyses of the various segments - from waste generation, recycling to re-use - is necessary. The nutrient recycling loop concept is very helpful in this process (see Figure 8.3). The recycling loop is represented in this figure by various segments: urban consumption and waste generation, waste processing, compost demand for agriculture, along with an economic feedback mechanism and finally the legal, institutional and communal settings throughout the loop. (Drechsel et al., 2002)

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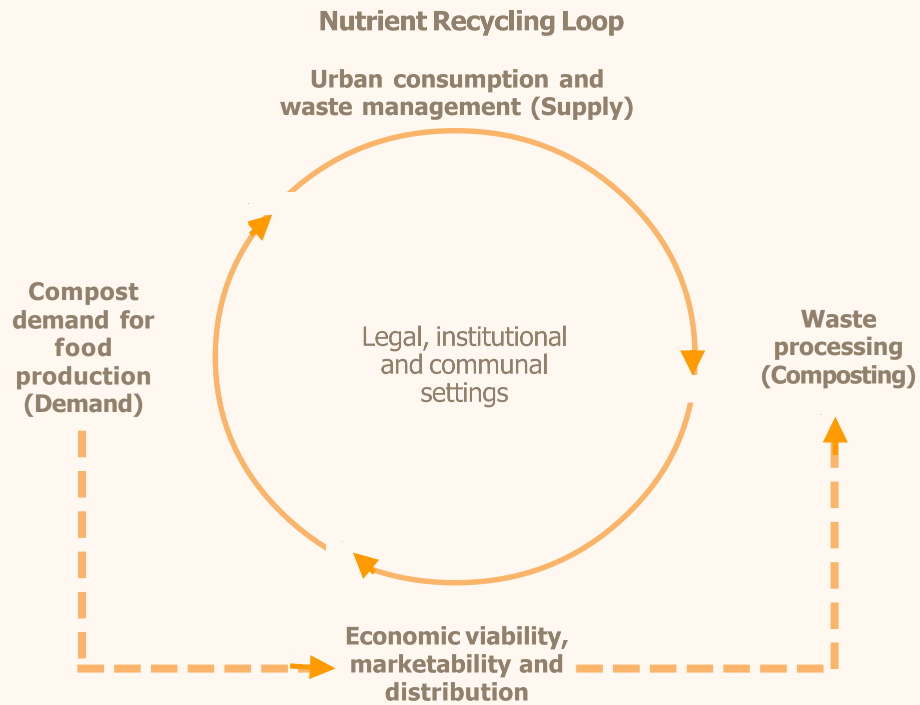
Community involvement in waste collection

The first segment of the loop, *urban consumption and waste generation,* addresses the supply dimensions of urban waste. It raises questions regarding organic waste production, location, ownership, quality, quantity, time, availability, value, health & safety constraints, etc. This is followed by the second segment *waste processing*, where questions are raised on (possibility of) organic waste transportation, appropriate processing methods (i.e. composting), production capacity, operation costs, sustainability, subsidies etc). The third segment deals with *compost demand* and address questions on users' demand, application, experiences, ability and willingness to pay, cultural constraints, etc. In addition to these three segments, there is an economic analysis linking the demand and composting segments that addresses economic viability, marketability and distribution. The final element looks at the *legal, institutional and communal setting,* in which the issues of planning, regulations, by-laws, policy constraints or support, land availability, local stakeholder participation, monitoring & evaluation, inter/intra-sectoral corporations, etc. are addressed, throughout the cycle of analysis.

This nutrient recycling loop is used to scope and assess all the processes involved in recycling organic waste into a valuable resource at municipal (centralised), community (decentralised) and/or household (backyard) levels for use in urban agriculture. The model provides a diagrammatic illustration of the systematic processes that are involved in selecting an appropriate organic waste recycling technology at the appropriate scale of intervention. For an urban farmer this process may take the form of a rapid appraisal or scribbles on the back of an envelope, whereas for a community-based organisation or a municipal authority it will form a logical guide to a more detailed and rigorous assessment study.

The recycling loop gives the required framework and potential best practice for planning composting for urban agriculture (Cofie et al., 2001, Drechsel et al., 2002, 2004, Danso et al., 2005). The questions which should be addressed at each moment in this cycle are summarised in Figure 8.3. The effectiveness and usefulness of this framework was tested in Ghana (Drechsel et al., 2004) using specific methods in the analysis of each segment of the recycling loop. It is important to note however that the analysis can have various degree of sophistication depending on the specific location, scale of the intended composting project, available funds, etc.

Figure 8.3 *The Nutrient Recycling Loop (modified from Drechsel et al., 2002).*



Application of the Nutrient Loop

The supply of organic waste

The key question in the waste supply context is: *Where* is *which* amount of waste of *what* kind of quality and *when* is it available for composting? This will allow identification of recycling needs in terms of design and capacity. Supply studies should focus on the various types, amounts, quality, present and potential uses, current value and availability of organic municipal waste for composting. The analysis of waste supply in West Africa showed that the availability of organic waste is not the limiting factor for compost production, although, not every form of waste is always available as there are often alternative uses (fodder, fuel etc) and seasonal variations. A comparison of waste generation and availability along a south to north gradient from Accra, Ghana to Ouagadougou in Burkina Faso showed that with decreasing biomass production, the amount of organic waste and related nutrient availability per capita decreases progressively as dryer eco-zones are encountered (Danso et al., 2005)

A result of waste surveys in Ouagadougou (Eaton, 2003) indicated that 80,000 tons of organic waste is produced each year in the form of solid household waste with a nitrogen content of 26 tons. It was estimated that about 25,000 tons of organic material per year could be composted and sold to farmers for application on a relatively modest estimate of 200 ha of intensive urban horticulture plots. This would correspond to an estimated 8 tons of nitrogen. This leaves approximately 55,000 tons of organic material per year that could be spread over an area of 8,500 hectares of peri-urban staple crop fields, a flow of approximately 18 tons of nitrogen. In other words, the supply of organic material is much more than can be realistically absorbed in agriculture, at least given current economic circumstances (Tessier, A. 2004).

The demand for waste-derived compost

The demand assessment includes the characterisation of all potential clients under consideration of their willingness (and ability) to pay (WTP). It is expected that a major demand for compost in rapidly expanding cities will come from landscape designers (horticulturists, parks and gardens) and real estate developers, so this sector must not be left out in the analysis. The demand analysis should also consider socio-cultural aspects, farm economics, attitudes/perceptions of users of waste compost and actual demand projections. Danso et al., (2005) reported for Ghana that many urban farmers have positive perceptions and are willing to use compost although not all have the necessary experience. Farmers' interest in compost was both for its plant-growth enhancing (fertility) effect and soil amelioration. Variations in WTP were recorded between farmers with and without compost experience, different farming systems, urban and peri-urban farms, as well as between different cities with different compost alternatives. The WTP expressed by farmers who already used compost was in several cases lower than among non-users. This was due to past experience with poor quality compost (in Accra) which resulted in poor crop performance and the negligible market demand for "organically" produced crops in Kumasi.

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Waste collection in Lomé

The study further revealed that estate developers were willing to pay higher prices for compost than urban and peri-urban farmers. In comparison to agriculture, the real estate sector has much lower qualitative requirements as compost will mostly be used for lawns and ornamentals. Thus the real estate sector could be the "favourite" customer group with options for private-public partnerships with the municipality. The financial strength of the real estate sector could subsidise parts of the compost production for agriculture.

The process of waste composting

The process of waste composting includes the determination of the type of facility, optimal number, capacity, and location of compost stations per city. Most critical in this assessment is to include possible ways of composting and determine the number of potential compost stations and station capacity with due consideration of waste supply and compost demand. Composting is best achieved by providing optimal conditions for the micro-organisms through the best combination of air, moisture, temperature and organic materials (Agromisa, 1999). Composting processes can be aerobic (with oxygen) or anaerobic (without oxygen) and even alternate between the two during the decomposition process. Anaerobic composting is a low-temperature process that is not recommended for urban agriculture due to the strong odours and the inability to destroy harmful pathogens that may be present in urban organic waste. Conversely, aerobic composting is a high-temperature process due to the development of microbes that generate higher temperatures in the compost pile. The key factors affecting the biological decomposition processes and/or the resulting compost quality are listed in box 8.3

Box 8.3 *Factors affecting biological decomposition*

- Carbon to nitrogen ratio
- Moisture content
- Oxygen supply, aeration
- Particle size
- pH
- Temperature
- Turning frequency
- Micro-organisms and invertebrates
- Control of pathogens
- Degree of decomposition
- Nitrogen conservation

The choice of a technology for aerobic composting will depend on the location of the facility, the capital available and the amount and type of waste delivered to the site. The two main types of systems generally distinguished are: 1) open systems such as windrows and static piles and 2) closed "in-vessel" systems. These "in-vessel" or "reactor" systems can be static or movable closed structures where aeration and moisture is controlled by mechanical means and often requires an external energy supply. (see the Kumasi, Ghana case study by Adam-Bradford). Such systems are usually investment intensive and also more expensive to operate and maintain. "Open" systems are the ones most frequently used in developing countries. They can be classified as:

Windrow, heap or pile composting: The material is piled up in heaps or elongated heaps (called windrows).

Olufunke Cofie

Compost heaps at Kumasi co-composting plant

Bin composting: Compared to windrow systems, bin systems are contained by a constructed structure on three or all four sides of the pile. The advantage here is a more efficient use of space. (for illustrations see the Kumasi, Ghana case study).

Trench and pit composting: Trench and pit systems are characterised by heaps which are partly or fully contained under the soil surface. Structuring the heap with bulky material or turning is usually the choice for best aeration. Control of leaching is difficult in trench or pit composting. In some cases, composting materials are completely buried in the trench which then serves as a planting bed, for example Mtshepo's home gardening in South Africa.

The aerobic composting process can last from a few weeks to 3-4 months, depending on the type of composting feedstock and the method of composting.

Olufunke Cofie

Mtshepo's home gardening in South Africa

Locally made composting pits in Tamale, Ghana

Emerging trends include the practice of vermiculture and the use of effective micro-organisms (EM) to accelerate the composting process. *Vermiculture* is the use of worms to digest organic waste into rich humus, similar to compost, that can then be applied in urban agriculture. Local varieties of both surface and burrowing earthworms can be used, although the latter are particularly suited as they not only digest organic matter but also modify the soil structure. Vermiculture is particularly suited to urban agriculture because it can be applied in a variety of settings and at different scales. The practice is also used very often as part of integrated gardening in community building urban agriculture (see chapter 6). Indeed, broad-scale vermiculture is widespread in India, Indonesia and the Philippines (GFA-Umwelt, 1999), while the practice has recently been gaining ground in Cuba and Argentina (Dubbeling and Santandreu, 2003; Viljoen and Howe, 2005). In broad-scale vermiculture, the earthworms are introduced to organic waste piled in elongated rows that are covered with some form of vegetative protection to prevent water logging (Ismail, 1997).

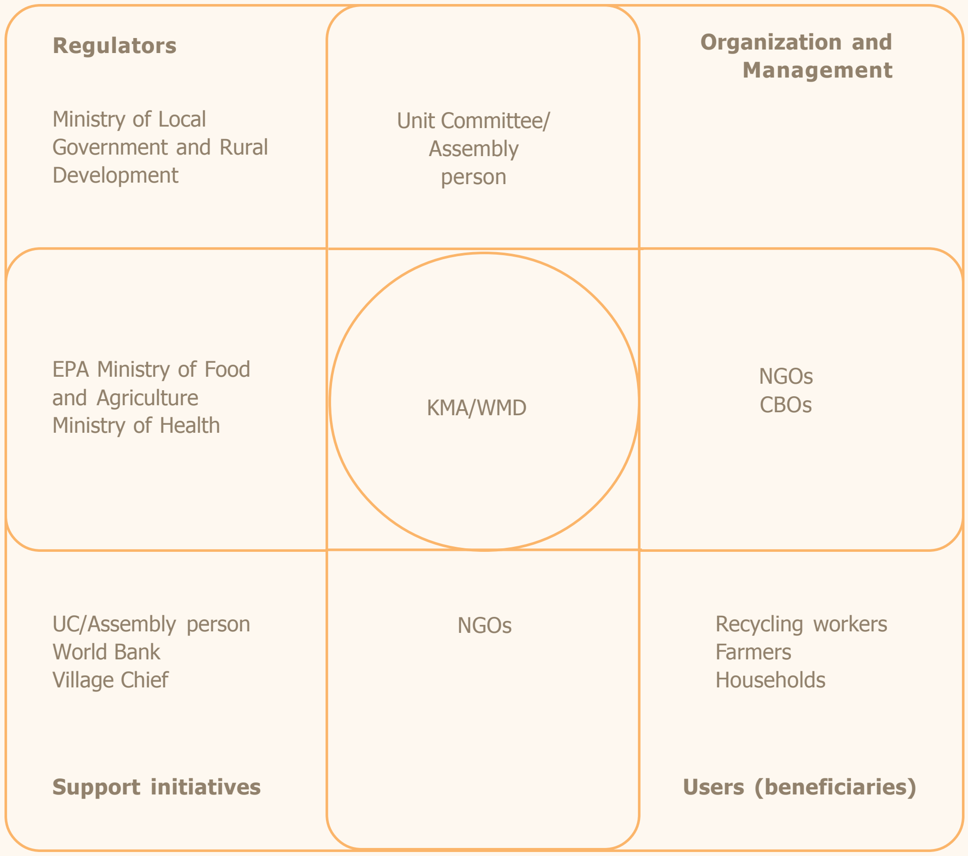
Economics of waste composting

The economic analysis links the supply, demand and process segments. This refers to consideration of the viability of the proposed compost station. GTZ-GFA (1999) has developed a model to assess the economic feasibility of compost stations. Analytical scenarios need to address different levels of technical sophistication and the actual and potential (but realistic) transport capacity of the city-specific waste collection system including profitability and investment analysis for constructing and operating compost facilities in the specific city. Such an analysis was done for Accra (Drechsel et al., 2004) and the results show that the overall cost of building and operating composting facilities in the Accra-Tema Metropolitan area is much lower than for incineration and land filling. Further more, using land fills is about 95 percent cheaper than incineration under prevailing Ghanaian conditions. The unavailability of land for landfills, incinerators and their transfer stations, and the requirements for meeting environmental quality standards are the major causes of the high capital cost of land-filling and incineration in the area. Composting urban solid waste appears to have the highest total economic benefits especially through labour-absorption.

Legal, institutional and communal settings

Legal, institutional and communal factors affect the set-up and sustainable management of compost stations. The legal, institutional and administrative context within which composting and the use of compost could be feasible concerns the environmental and sanitation by-laws and policies as well as public awareness and the roles and perceptions of authorities and other interest groups, especially CBOs and NGOs in composting. Various stakeholder institutions could play the role of regulator, manager, supporter of initiatives or beneficiary. Through stakeholder analysis and role clustering, it is possible to identify which institutions play a central role or a secondary role (See Figure 8.4). These institutions in two or more role clusters also play an important role inter-linking other institutions

Figure 8.4 *Institutional Platform for recycling of organic waste in Kumasi, Ghana (Source: Vázquez,, 2002)*



Vasquez et al., 2003 reported related work done in Kumasi, Ghana and observed that the Waste Management Department (WMD) of Kumasi Metropolitan Assembly (KMA) is the central institution to provide assistance on, or to facilitate the regulation, support (financial, technical, human resource), as well as organisation and management of organic waste recycling. Dissemination of information and services from the platform (in the centre) to the beneficiaries (in the nutrient loop) together with feedback from the beneficiaries to the platform provides a mechanism for system improvements and sustainability.

Health Implications of Organic Waste Recycling

A considerable amount of research has been done on the health implications of organic waste recycling (eg. Cairncross and Feachem, 1993; Birley and Lock, 1999; Furedy et al., 1999; Furedy, 2001). Health implications are a major constraint to recycling organic waste in urban agriculture (Asomani-Boateng and Haight, 1999), in addition to the issues of economic viability and attitude and behaviour (especially of officials). Due to the close connection of organic waste recycling with the food chain, the issue of health is crucial, not just for farmers engaged in urban agriculture, but also for consumers of the products that are derived from recycled organic waste (Asomani-Boateng and Haight, 1999). The often negative perception held by municipal authorities is associated with the use of recycled organic waste in urban agriculture as a "detriment to modern urbanity and a health hazard" (Asomani-Boateng and Haight, 1999). Furedy identifies the principal health hazards as: "survival of pathogenic organisms in residues; Zoonoses associated with animal wastes; increase of disease vectors; respiratory problems from dust and gases; injuries from sharp fragments; and contamination of crops from heavy metal take-up and agrochemical residues via wastes and their leachates" (Furedy, 2001).

Indeed, when urban solid waste contains high levels of human excreta, the application of such wastes in agriculture requires careful management (Asomani-Boateng and Haight, 1999). In addition, when compost piles are badly managed, pathogens such as nematodes and parasite eggs that may be present in the organic waste could survive the decomposition process and be carried to farmers' fields and plots when composts are applied to soils (Birley and Lock, 1999).

Simple health and safety protection measures can be taken to mitigate many of these health hazards by reducing the possible transmission pathways through the use of protective clothing. Compost workers should be equipped with rubber boots, work gloves, and mouth & nose masks to ensure protection. Training and education in the safe handling of wastes and in basic first aid should be given to compost workers and on-site washing facilities and a first aid point should be provided at the workstation. In composting plants, particularly where co-composting techniques are utilised, the regular monitoring of the final compost product is required to ensure that any pathogens present are inactivated during the decomposition process.

Almitra Patel

Mysore Compost Plant

Of course, there are many situations when a trade-off has to be made. For many poor and subsistence urban farmers, curtailing any hazardous agricultural practice is simply not a viable option. Urban agriculture is a lifeline for many of the world's urban poor, and therefore in most cases attempting to balance the health trade-off will be the preferred solution. Consequently, educating farmers in risk minimisation may well be the most appropriate option. For example, improving waste separation and collection at the organic waste set-out point is one method that can minimise the contamination of organic wastes.

Chemical contamination is another potential risk associated with re-use of organic waste. As organic solid waste is often stored and collected together with other waste fractions, contamination of the organic fraction is easily possible by chemical constituents, especially heavy metals. When applying contaminated compost, these constituents can accumulate in soils. The contamination of soils by chemicals, the potential uptake by crops, and the possible chronic and long-term toxic effects in humans are discussed by Chang et al., (1995) and by Birley and Lock (1997). Plant uptake of heavy metals depends significantly on the metal itself as well as compost and soil conditions. Similarly, the presence of a given metal can be harmful in one soil and harmless in another. A number of other parameters have to be known before any risk assessment related to heavy metals is possible. Metals in municipal waste come from a variety of sources. Batteries, consumer electronics, ceramics, light bulbs, house dust and paint chips, used motor oils, plastics, and some inks and glass can all introduce metal contaminants into the solid waste stream. Even after most contaminants have been removed through sorting, the compost may still contain these elements, although in very low concentrations.

In small amounts, many of these trace elements (eg. boron, zinc, copper, and nickel) are essential for plant growth. However, in higher concentrations they may decrease plant growth. Other trace elements (eg. arsenic, cadmium, lead, and mercury) are of greater concern primarily because of their potential to harm soil organisms or plants and possible entry into the food chain. The impact of these metals on plants grown in compost-amended or wastewater-irrigated soils depends not only on the concentration of metals and soil/compost properties as mentioned above, but also on the type of crop grown. Different types of plants can absorb and tolerate metals differently. For instance mushrooms should not be cultivated on soil ameliorated with mercury- or cadmium-rich compost. In general, however, there is little evidence of crop contamination through compost. The application of municipal solid waste composts might, however, increase the metal content of uncontaminated soils. This may pose a risk to animals or children in the area who could ingest the composted soil directly.


A. Adam-Bradford

Organic rich compost produced from domestic waste

Further risks arise from impurities of non-biodegradable origin such as glass splinters or other sharp objects contained in the compost product. Such impurities can be a result of insufficiently sorted municipal solid waste before or after the composting process.

There are also indirect health risks caused by the attraction and proliferation of rodents and other disease carrying vectors (Furedy and Chowdhury, 1996).

Challenges Ahead

Composting raises issues not only of the technological approach used, but also of the necessary organisational set-up for operation and management of the composting, delivery of feedstock (raw material) and distribution of the compost product as well as proper extension or education. Hoornweg et al. (1999) list several reasons why the use of organic waste and composting in particular are not widely or successfully practisd in cities of developing countries.

- Insufficient knowledge and care in carrying out composting operations leading to inadequate compost quality and resulting in odours and rodent attraction that is deemed a nuisance.
- Lack of markets for the product and lack of appropriate compost marketing strategies and skills.
- Neglect of the economics of composting which relies on externalities, such as reduced soil erosion, reduced water pollution and avoided disposal costs.
- Limited support by municipal authorities who tend to prioritise centralised waste collection services rather than promote and support recycling activities and decentralised composting schemes.

In addition, the following issues related to organic waste recycling require applied research:

- Appropriate methods of segregation at source or sorting procedures to allow delivery or utilisation of pure organic solid waste for the co-composting process and to limit risks of compost contamination by impurities and chemical constituents;
- Marketing strategies and institutional framework
- Regulatory frameworks and realistic standards for compost use.

The recycling of urban organic waste brings several ecological advantages that can enhance energy efficiency through carbon, nutrient and water conservation in urban and peri-urban landscapes (Holmgren, 2002). These advantages can be categorised as the micro-environment benefits as they relate directly to soil amelioration measures, but in addition, energy efficiency should also be considered in the broader sense to encapsulate the wider advantages that can be accrued at national, regional and international scales. For example, recycling organic waste through composting in urban agriculture reduces the need to import chemical fertilizers and food stuffs. Furthermore, when urban organic waste recycling is decentralised there is reduced need for external inputs such as equipment, fuel and transportation.

Many urban and peri-urban areas are vast nutrient sinks as the recyclable nutrient potential from organic waste is seldom exploited and thus lost. This is compounded by the combination of soil nutrient mining in rural and peri-urban production areas and the accumulation of urban organic waste in the disposal sites. In these sites the mined nutrients accumulate in the peri-urban areas, largely through informal waste disposal due to the inefficiency of formal waste disposal structures (Drechsel and Kunze, 2001; Cofie, 2002).

Reversing these trends and patterns requires the adoption of holistic and integrated approaches to organic waste recycling that seek to optimise the use of a combination of methods at appropriate scales of intervention to manage organic waste in urban agriculture is a sustainable way. This means closing the nutrient recycling loop by reversing the negative impact of urban and peri-urban nutrient sinks through maximising nutrient exploitation of urban organic wastes. Furthermore, such interventions can be designed to generate livelihoods and thus contribute to urban food security. The combination of methods at appropriate scales allows for the design of interventions that are geographically applicable to the prevailing urban conditions, while exploiting urban organic waste for urban agriculture also enhances environmental protection by reducing organic waste quantities, as well as reducing the need for inorganic fertilizers in urban agriculture.

Pay Drechsel

Community based compost station in Accra.

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Figure 8.5 *Questions to be addressed for an appropriate establishment of municipal compost stations for (peri)urban agriculture and other uses (modified from Harris et al., 2001)*

Supply

What organic wastes are produced?
Where are they produced /disposed?
Is the waste treated? How?
What are the current disposal costs and/or environmental/social externalities?
What is the quality (potential soil fertility value) of the material and is the material contaminated or phytotoxic?
Are there seasonal variations in its availability or quality?
Who owns the waste?
What is the current use of the waste? (Are there competing uses in comparison with composting, for example untreated fertilizer, livestock feed, fuel, or recycled for other manufacture or use?)
What is the related market demand and economic waste value?
How much/which waste is unused and the de facto available for composting?
Are there waste use/collection constraints related to health, handling, safety and environment which could be addressed?

Institutional, legal and communal framework

Are there constraints/support related to official plans, programmes, regulations, by-laws or policies and how could we make best use of them?
Are there constraints to the set-up of compost stations related to land availability?
What are the official attitudes and recommendations eg. at institutional/ municipal/communal level?
Could inter/intra-sectoral cooperation be improved (platform building)?
How can local key groups/stakeholders become involved (community based stations)?
What are the implications of composting for these groups and what kind of commitment/input would be necessary from them?
What management settings and instruments (M&E, accounting, O&M, etc.) would be most appropriate?

Demand

Who is interested in compost (urban and peri-urban farming systems, real estate, landscape design, horticulture, etc.)?
What is their experience and/or perception of the product?
What are their requirements on the product?
What is their ability and willingness to pay for the product?
Are there special constraints to compost use related to cultural aspects (taboos), gender, compost marketing, handling?
How high is the likely demand and how does it vary over the year?

Processing

Is composting the most appropriate method to treat the waste for soil improvement?
What should be the capacity of the compost production (comparing supply and demand)?
Which technologies appear appropriate (which technologies have been applied successfully in the sub-region)?
Are these technologies locally available?
Is appropriate maintenance of these technologies likely/possible?
Are there technical waste-use constraints related to separation/collection/transport and how could we address them?
What is the transport capacity of the waste collectors?
What is the public perception towards source separation or composting?
What is the location of the waste sources and of the potential compost users?
How many compost stations are needed to keep transport costs low?

Economics

What would be the total establishment and running costs?
Which (economic) benefits for the society at large are possible?
Can these justify municipal subsidies?
What is the best mixture of waste from different sources?
How to realise co-composting?

Table 8.1 *Some compost facilities compared in West Africa (Dreschsel et., 2004)*

Name and Location of Compost Facility	Teshie-Nungua, Accra, Ghana	Zogbo and Houeyiho Cotonou, Benin	Hèvié Compost Plan Benin
Year of Establishment	1980	1994	1998
Realistic production capacity (tons compost)	up to 11,000	360	1200-2000
Access to Sources of Organic Material	Easy Access to Organic Waste	No easy access to MSW	Easy access to MSW waste, and slaughterhouse Waste
Method of Waste Collection	House-to-house collection system *Communal*	House-to-house collection system	Curb-side collection system
Technology Employed	Capital intensive Mixed MSW Composting	Labour-intensive. Waste separated before composting	Labour-intensive. Manually separated waste composting
Problems facing Compost Facility	- Lack of spare parts, water, training and public education programmes, and reliable energy sources.	- Poor quality of Compost	- Complaints about bad odour. facility
	- Poor funding of maintenance	- Low priced competing products such as poultry droppings, 'black soil', animal anure, raw waste, etc.	- Cheaper priced competing products such as black soil, poultry droppngs, animal manure, etc.
	-No clearly defined marketing strategies	- Lower market prices of compos than production cost	- Poor marketing strategies
	- Persistent public complaints about location	- Lack of training programmes of operator	- Located far from farmers and other compost users.
	- No collaboration & networking amongst stakeholders	- Difficulty in accepting the value of compost	

Hèvié Compost Plant, Benin	Bodija Plant, Ibadan, Nigeria	Lome and Tsévié ,Togo	Wogodogo,Ouagadougou, Burkina-Faso
1998	1985	1998	1998
1200-2000	3000	900	3000
Easy access to MSW waste, and slaughterhouse Waste	Easy access to Bodija market	Easy access to MSW	Easy access to MSW
Curb-side collection system	Curb-side collection system (communal) *containers)*	House-to-house source separated waste collection system & communal containers.	House-to-house collection system & Curb-side system
Labour-intensive. Manually separated waste composting	Labour-intensive. Manually separated waste composting	Labour-intensive, source separated composting	Labour-intensive, manually separated composting
- Complaints about bad odour. facility	- Political bickering over ownership of Togo.	- Problem of replicating technology elsewhere in	- Cheaper priced competing products.
- Cheaper priced competing products such as black soil, poultry droppngs, animal manure, etc.	- Inadequate working capital.	- Inadequate funding.	- Lack of public education on the benefits of compost and source separation
- Poor marketing strategies	- Poor quality of compost	- Poor marketing strategies	- Poor marketing strategies
- Located far from farmers and other compost users.	- Lack of skilled personnel to manage the plant.	- Poor quality of compost	

Planning in a Changing Environment: The Case of Marilao in the Philippines

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Joseph Batac
Pay Drechsel

Marilao is a municipality with approximately 15,000 households located on the fringe of Manila in the Philippines. At the end of the nineties, Marilao's authorities faced a typical peri-urban dilemma. With only 2,625 hectares of land area, just five kilometres away from Metro Manila, Marilao's mayor could not find affordable land for a new waste disposal site. There were more than 850 business firms and housing projects that competed for the use of municipal land. The problem was not just where to bring the waste. What to do with the recycled waste and what changes in policy and urban management needed to be made were also issues to be tackled.

Breaking with Traditional Planning Habits

The answers to the challenging question, "Where do we bring our waste?" posed in 1995 by the mayor, involved complex concepts high in capital investment requirements, but no affordable or practicable ideas. The precarious situation was emphasised during a series of community planning workshops in 1997 in search of reducing waste by getting all major stakeholders involved. With the gigantic waste problems of Metro Manila in mind, Marilao's authorities decided to go a different way, and involving the community instead.

Joseph Batac

Vegetables grown in pots

The problem, however, was that the anticipated involvement of the community had to be tested in a country where the style of municipal governance is predominantly administrative-oriented rather than participatory. Planning has been a purely technical matter guided by a corresponding manual. However, the preparation of the development plan with community involvement, required interactive consultations with different sectors of the community. Most of the planning officers found it difficult to organise such multi-sectoral consultations. The tools and methodologies required for participatory processes had to be adopted from the NGO community. It was even more challenging to apply them in an environment, which was used to a regulatory style of management. Moreover, experience has shown that a regulatory framework alone is hardly effective, even in the Philippines, which has one of the most stringent environmental laws in Southeast Asia.

Thus, a new style of local governance was required. The basis for this new style was given in 1992, when municipal local government units (MLGUs) were mandated by law to be autonomous with specific powers, functions and revenue. The mandate was anchored in certain principles, among which is the pursuit of an ecological balance and participatory processes of managing development. Each of the 1,525 units in the Philippines can have their own interpretation of these two principles, given their actual conditions and the management capacity to change them. Within this favourable atmosphere for near autonomous local governance, the municipal authority of Marilao together with NGOs, started in 1996 to brainstorm on appropriate solutions, more stakeholder participation and on investment programmes to overcome the waste crisis. It was estimated that the existing landfill would be full in about 3-5 years. Another study revealed that almost 50 percent of the current content was biodegradable waste; 30 percent could be recycled and only 20 percent consisted of non-usable materials.

The leaders of the municipal local government units and of the NGOs decided to look for ways to recover the major portion of the waste. Four months later, a proposal was finalised for the municipality to establish a composting facility, while the NGO community was to address the necessary change in behaviour of the main waste generator: the households in the municipality.

This solution was in fact supported by the Integrated Solid Waste System Framework (Presidential Task Force on Solid Waste Management 1993), which addressed the separation and processing of biodegradable waste into compost. Composting had been promoted by the national government under a specific programme since 1990 (Anonymous 1990), but like the Framework, it was more wishful thinking than implementation. To improve the situation, the national government provided a model ordinance in 1996 (Anonymous 1996) to implement an integrated solid waste management system in municipalities. Thus, Marilao was probably the first municipality actively implementing this policy.

To ensure the stable supply of organic household waste, source separation was initiated at the household level in late 1997, followed by a series of campaigns in the next two years. The activities in these campaigns involved workshops, cross visits, seminars, training, video films (on community cable TV), the playing of jingles during collection, providing the collection crew with a uniform, heralding the message of waste segregation, printing of calendars and community newsletters, and periodic letters from the mayor. The costs of these activities were shared between the NGOs and the municipality.

In general, principles of marketing were utilised for all activities, starting with an analysis of the clientele to ascertain their existing knowledge, attitude and practices (KAP). The ideal profile of potential clients was formulated and its 'appeal' determined. Distribution channels as well as promotional activities were then set up. NGOs drove the process of product development for community change. The process utilised participatory planning techniques that were designed by the NGOs. The planning interfaces again involved both the NGO leaders and the municipal staff, and were placed within the Municipal Development Planning Council (MDPC). Each year, a work plan was agreed upon and translated into investment by the municipality. The agreement only took effect after a series of consultations with community stakeholders and the mapping of internal strengths and weaknesses as well as of external threats and opportunities. This was followed by the identification of strategies, consensus on the preferred strategy, translation of this consensus into activities, and the contribution of municipal investments as well as NGO counterpart activities to implement the strategy. These investments included developing models on urban agriculture and improvements on the collection system for solid waste management. From 1995 to 2000, a total of USD 10,000 was allocated for developing models on urban agriculture. The investment for the collection system reached USD 15,000.

Reaching Households

The adoption of the practice of waste segregation was initially slow but accelerated over time. The municipality offered a predictable and reliable collection of *segregated* waste as an incentive, and this meant a lot in Marilao. Within three weeks, the 500 households in the first area adopted the practice, seeing that the waste collection really was predictable and more frequent. After three months, an adjoining area with 400 households decided to adopt the practice. Another 2,000 households from the contiguous area followed six months later, and the municipality had to buy more collection vehicles to maintain the promised collection frequency. Today, almost all the 15,000 households of Marilao benefit from the system by providing source separation.

The Nurture Plan

This regular supply of biodegradable waste allowed the municipality to produce compost at a rate of approximately one ton per day by using a compost fungus activator to reduce the composting time from three months to one month. The set-up of the technology needs both waste from urban households and a market, which are the urban farmers of Marilao. Initially, the compost was given to urban farmers together with seeds and tools. When the municipality realised that the compost supply could not cope with the demand, and farmers also asked for application guidelines of the compost and related information, the NURTURE plan (*Networking for Urban Renewal Through Urban Ecology)* was established.

The NURTURE plan identified the farmers who practise solid waste segregation and have open spaces within their yards and/or in contiguous areas. Three strategies were identified based on the crops grown: (i) food security, (ii) recreation and aesthetics, and (iii) livelihood. The farmers targeted for "food security" are the urban poor who cultivate high nutritive crops that supplement micro-nutrient deficiency, especially among children. The target group for "recreation and aesthetics" is middle class households who grow ornamentals and plants with fragrant flowers; and the "livelihood" strategy addresses farmers growing potted crops/flowers mainly during the off-season.

All three groups encountered the problem of access to land. The NURTURE plan addressed this by developing compact gardens with a standard soil composition. At first, the plan targeted guidelines for compost application, but it had to struggle with large inner-urban variations in soil quality, and some urban areas even had no soil at all but only concrete. Yet they faced a demand from farmers using pots and other containers to grow vegetables or flowers. To address this situation, the municipality carried out a series of practical experiments in 1999, which resulted in a standard substrate with compost as the predominant material for pot cultures and raised beds with rain shelters.

The farmers were organised under the umbrella of the Marilao Federation of Service Organisation (MAFESO). The MAFESO is a network of 75 community-based housing associations, church/religious groups, sectoral groups like women and transport workers, and civic clubs. In each of these organisations, there are many members who have been actively involved in the activities of solid waste recycling and urban agriculture. These members periodically plan and discuss their activities within a working committee under the MAFESO and the Municipal Development Planning Council (MDPC). The members are critical in technology applications and testing, land access arrangements and implementing the investment plan as approved in the MDPC.

The Message Spread

After a meeting with Mayor Duran of Marilao, the chairman of the Government of Metro Manila instructed his senior staff to study the Marilao model via one-day cross visits. Several more local government representatives went to Marilao on cross visits to learn about the project. In addition, national government as well as donor agencies published articles on the project, and in April 2000, the wife of President Estrada visited Marilao to learn about urban agriculture. Officials from the largest NGO in Metro Manila working on solid waste management and recycling accompanied her.

All of these interested groups and institutions had one common question – how did the programme start? The Marilao experience showed that the way to success is a stony one, which challenges old structures and planning habits. The required shift in mindset of officials and style of governance to manage development with community change can only happen when there is a strong political will. This is necessary to motivate the NGOs as well as the communities. Once there is political will, the technical aspects can be modified with a greater degree of tolerance for correction in the context of improvement. The Marilao experience has also shown that municipal planning can serve as a focus of development, as long as more participatory style of management is followed. This commitment then easily translates into investment for community mobilisation and logistics for both short and long term.

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Container Composting in Peri-urban Kumasi, Ghana

A. Adam-Bradford

This case study reports on the experimental implementation of container composting methods in Ghana's second largest city, Kumasi [1]. Container composting can be simply defined as the use of a receptacle or structure in which organic waste matter is composted. Using a container for composting bestows several advantages that make the practice particularly suitable for urban and peri-urban agriculture (UPA), where close proximity to human settlements becomes a consideration. Composting domestic organic waste in an urban environment may create breeding sites for disease vectors (eg. flies, mosquitoes, cockroaches, rats), attract snakes that feed on the vermin and give rise to unpleasant odours. Using composting containers can not only mitigate many of these problems, but also protect the compost pile from being adulterated with contaminated wastes, and furthermore, when good handling skills are applied, allow for extremely efficient decomposition rates. Composting then remains safe, hygienic and acceptable to local residents and, more importantly, conforms to local environmental sanitation by-laws.

Andrew Bradford

Easy to operate 'Suame' compost tumbler

Table 8.2 *Advantages and disadvantages of container composting*

Advantages	Disadvantages
Closed container	Requires drainage
Small space required	Requires regular handling
Low odour emissions	Requires aerating manually
Protection against water logging	Requires education and training of the user
Protection against moisture loss	Prevalence of anaerobic conditions
Use of recycled materials for construction of containers	Emission of odours when handled inappropriately
Control and monitoring of waste inputs	Requires motivation
Handling of small organic waste quantities	Purpose-built containers - cost intensive
Protection against pests, vermin and snakes	Thermophilic microbes may not develop
Prevents domestic organic waste at source from entering urban waste stream	

Source: field observations, 1999-2005 and modified from GFA-Umwelt, 1999.

Decomposition Process

Compost containers can be used to easily obtain the optimal decomposition conditions for organic waste by regulating the air, humidity and temperature during the composting process and thus create the ideal environment for micro-organism development (bacteria, protozoans, fungi, invertebrates). Good handling of the compost pile accelerates the decomposition rate while also minimising the nutrient loss. Good practices include cutting up and shredding the organic waste, turning the pile to increase aeration, sprinkling water on the pile if it becomes too dry (dusty with ants), and keeping the container closed during heavy rains to prevent (the pile from) water logging.

Maintaining the optimal C/N ratio of 25-30/1 may require careful monitoring and appropriate handling, as nitrogen levels are often quite high when composting domestic organic waste in containers due to the concentration of nitrogen-rich matter and limited aeration. Under such conditions the compost becomes putrid, acidic and compacts, and its quality deteriorates. This then leads to high odour emissions and the prevalence of anaerobic conditions. Turning the pile and adding dry porous materials (carbon rich), such as leaves, sawdust, or straw, can easily rectify this problem. It should be noted that if anaerobic conditions prevail thermophilic microbes may not develop, and consequently, thermophilic temperatures may not be achieved. However, in container composting this is not so crucial as only domestic organic waste is used, rather than waste from unknown sources that may contain unwanted (i.e. human) pathogens and/or agricultural residues that may contain crop diseases and/or weed seeds.

Andrew Bradford

Block-built double chamber compost bin in Esereso, Kumasi

Container Design and Use

Containers can be purpose built (eg. from bricks, blocks, plastic barrels, wicker baskets) or constructed from recycled materials (eg. oil drums, plastic barrels, building materials). The space required for a composting site is approximately 1.5-2m^2 per household (in peri-urban Kumasi an average traditional household consists of 10 adults and 8 children). This allocated area allows enough space to place two containers side by side, or to build two chambers if using bricks or blocks (height 1m); sufficient working space should be maintained around the front of the containers. The chambers are filled sequentially, so that when the second chamber is full the compost in the first chamber can be emptied and the mature compost stored until ready for use. In designing containers, consideration has to be made for aeration vents, drainage, ground soil contact and overhead protection.

In Kumasi, the main container-composting method demonstrated was block-built compost bins chosen mainly because of the wide availability of building blocks. Cement was used in the construction of the double-chamber bins although gaps were left between the blocks in the bottom to facilitate aeration (left without mortar for temporary use), and then each chamber was covered with a wooden lid. In some locations and in six schools larger versions consisting of three high-capacity chambers were also built and demonstrated. But regardless of the type of container selected, some fundamental design principles need to be considered including:

- Pile compost directly on ground soil thus ensuring drainage and allowing contact with soil micro-organisms (in sealed containers provide drainage holes and add fresh compost in each cycle to ensure micro-organisms are present).
- Provide means of aeration in container walls (holes in drums or gaps between blocks).
- Use covers to close containers at night and regulate compost pile during day.

Performance and Problems

Container composting proved to be highly effective for decomposing organic waste, particularly when good composting practices were followed, specifically where organic materials were shredded and the compost pile frequently aerated. Problems encountered included compost compaction and putrefaction, low participant motivation and loss of the actual composting site. During the earlier phases, some project participants eager to fill their containers with organic waste invited their neighbours and friends to also use them. As the containers were designed for individual household use they were rapidly filled, which resulted in compost compaction and putrefaction. Removing the top layers and increasing aeration of the remaining compost pile remedied this. In places where the larger capacity triple-chamber containers were used this problem did not occur.

Despite the immediate benefit for women and children of not having to make the routine early morning trip carrying daily domestic waste to the local refuse dump, the participants' motivation decreased overtime. This largely stemmed from the programme's failure to incorporate sufficient training and support in entrepreneurial skills related to compost demand and marketing. When such training was provided, participants became extremely motivated in compost production. The success of composting programmes is not dependent on the composting method or container, but principally on 'intensive care and know-how of the individual' (GFA-Umwelt, 1999), including marketing knowledge and alternative compost uses. Finally, two compost sites were actually lost due to the extension of adjacent houses. Hence, where possible, composting interventions need to be planned around future developments, although in peri-urban areas where urbanisation is rapid and spontaneous, this becomes a challenge.

Policy Implications

In the six peri-urban locations 20 demonstrations were implemented and after 3-months 17 additional micro-projects had been taken up. Early spontaneous uptake of the technology was encouraging, with the number of installations almost doubling within three months of project initiation. However, the main obstacle to further uptake was financial constraints as the average construction cost of a block built double-chamber container was approximately 13 Euro, and exceeded the purchasing power of most peri-urban farmers. In two sites where the larger triple-chamber containers were constructed, several households shared the construction costs, although this then required a much greater level of self-monitoring and household coordination.

Separating and composting domestic waste at the household level can lead to substantial decreases in waste stream outputs and thus contribute to a cleaner environment, particularly in peri-urban areas that are plagued by unmanaged open waste dumps. However, in this activity, there is a time lag before the compost is produced and the subsequent benefits are gained, so the intervention must be well planned and sustainable, with project participants actively engaged in all stages of the planning and implementation process. Failure to adopt such an approach may result in the implementation of inappropriate technologies (see Hamdi, 2004). Furthermore, the successful implementation of container composting programmes requires substantial educational and training inputs across a range of topics including establishing compost sites, constructing compost containers, appropriate compost handling, compost use and compost marketing. In Kumasi, successful implementation was enhanced through the provision of demonstrations and information leaflets and the running of composting workshops. The latter became even more effective in time when the local project participants became proficient in demonstrating composting principles. Finally regular monitoring of the composting process is also required to enable problems to be addressed as and when they arise.

Conclusions

Container composting has the potential for creating a classical win-win situation by increasing urban and peri-urban agricultural production through appropriate soil fertility management, protecting the environment through the recycling of organic waste, and income and livelihood generation, which enhance urban and peri-urban food security (Drechsel and Kunze, 2001; Leitzinger, 2001). In the context of decentralised composting of urban waste at the household level, there exist a variety of interventions that meet low-cost requirements and that are appropriate in peri-urban areas. In Kumasi, interest in the introduced low-cost technologies has been high within the selected communities. Although several households have spontaneously adopted the techniques, supplying their own materials to construct compost containers, if such programmes are to be implemented on a wider and systematic scale, then financial assistance (or purpose-built compost containers) will be required.

Note

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Community-Based Compost Production for Urban Agriculture in Nairobi

Mary Njenga
Nancy Karanja

Population growth in Kenya is given as 5 percent in the past five years, while it is estimated that 20-40 percent of its inhabitants live in absolute poverty (MoPND, 2003). The poor in Nairobi seek food security and income through crop and animal keeping on small and insecure plots. Estimates by Foeken and Mwangi (2000) indicated that about 150,000 people or 30 percent of the households in Nairobi practice farming and that 80-85 percent of the cultivators are women.

Andy Bradford

Transporting household waste to a sorting site.

Nairobi's urbanites produce about 2000 tons of solid waste daily of which 60 percent is organic (JICA, 1997). Of the total waste produced in Nairobi, only 40 percent is collectively disposed of at dump sites (ITDG-EA, 2003). Heaps of garbage is found along roadsides and in residential estates. Despite the urban waste disposal problem, a well planned and regulated organic waste resource recovery is yet to be realised in many cities. This study illustrates that composting organic waste for reuse in urban agriculture is a way to alleviate urban poverty while contributing to solving the waste problem (with youth involvement) in Nairobi. Although the study did not primarily investigate the impact of composting schemes on poor urban dwellers, the results obtained nevertheless give interesting insights into these aspects.

The survey among CBOs

Low-income communities produce compost in the urban and peri-urban area in order to generate income and secure self-employment. A survey was conducted in 2003-2004 on the management of organic waste and livestock manure for enhancing agricultural productivity in urban and peri-urban Nairobi. Interviews were held with ten community-based organisations (CBOs)/self-help groups in Nairobi and with a CBO from the neighbouring town of Ruiru, specialised in compost production from dump site mining. These CBOs were identified from secondary data (Ishani et al., 2002; ITDG-EA, 2003). Individual and group interviews were done with a set of semi-structured questionnaires and checklists. The survey covered group dynamics, compost and manure production, use and marketing of the products. The CBOs were analysed on their environmental management and potential to alleviate poverty.

Results of interviews

The eleven CBOs compost about 0.6 percent or 2,500 tons of the total organic waste produced in Nairobi daily. All of them aimed at generating income and tried to contribute to environmental management. Some of them in addition were involved in raising health awareness and rehabilitating of street children. The groups had been formed between 1978 and 2001, and their members generally belong to the poor section of the population and included both men and women. In Ruiru town, the CBO was made up of young school leavers of the lowest social level with diverse backgrounds. Four of the interviewed groups are located in informal settlements, two in middle class residential estates, three in retail and wholesale small to medium agriculture produce markets and two in waste dump sites (one in the City Council of Nairobi and the other at the Ruiru dump site). All the groups are located within a radius of 25kms from the city centre, except for the Ruiru group which is 40 km away. All the groups surveyed were officially registered as self-help groups.

Different types of organic waste such as household waste, market refuse, food waste from canteens and hotels, as well as agro-industrial waste (i.e. coffee husks) are collected and used as raw material for composting. Two of the CBOs only used a single type of raw material, i.e. either market or dump site waste, whereas the other CBOs composted a mixture of different waste materials. Six groups transported waste to the composting sites using wheelbarrows, donkeys and carts. Those who did not transport the waste to another location carried out composting at the source – the dump site or the market. The compost produced by the CBOs was of lower quality to the commonly used cattle manure.


Nancy Karanja and Mary Njenga

Composting organic waste from the market

Different practices and materials used in composting resulted in a high variability in compost characteristics. Waste contamination at source was likely to be responsible for the high zinc and copper contents in the compost samples, particularly those taken from the dump sites. Two groups generated income by charging households for waste collection. Six groups had received formal training in compost making from development organisation such as UN-Habitat and Intermediate Technology Development Group (ITDG-EA), while others applied local knowledge which they had acquired in the rural areas. However, most of the formally-trained groups were reluctant to apply the acquired skills because they found the new/improved composting techniques labour-intensive and time consuming. Lack of space was the main challenge faced by the CBOs since composting was done either on rented or leased public land, or illegally on open spaces adjoining markets.

The study was undertaken by several different institutions that were working in partnership. The market survey identified plant nursery operators, residents of the high income estates for their ornamental gardens, and landscapers or estate developers as the main compost buyers, including a small number of small-scale and large-scale horticultural farmers from the city environs. The urban and peri-urban farmers who purchased and/or used compost were mainly those who were also members of the composting CBOs. Compost was transported by hired vehicles for distances of up to 50 km. For shorter distances, bicycles, wheelbarrows or carts were used. About 253 tons or 30 percent of the compost produced was sold at USD 67 – 133 per ton (compared to USD 14 – 24 per ton of cattle manure) which was thought to be too high considering the quality and the fact that most of the farmers still prefer chemical fertilisers.

The study revealed that compost production as a business venture is a challenge for the producer due to limited production knowledge leading to poor quality of compost. The demand for compost was very low due to lack of information on the origin of the compost and hence the fear of potential risks associated with urban waste such as heavy metal and pathogen contamination. It appeared that farmers and policy makers were largely unaware of the soil fertility and environmental management benefits of compost making.

Discussion of findings

High compost prices seem to be a major drawback to the success of this activity in uplifting the livelihoods of the youth and the poor in Nairobi in general. The high prices were not attractive to the poor urban farmers with limited resources coupled with insecure land tenure. It is not surprising that only 30 percent of the compost produced was sold, and that clients for compost were primarily business enterprises and large horticultural farms in the rural areas. These enterprises have a much better bargaining position as they can purchase large quantities of compost whereas the poor urban farmers with little land are forced to pay high prices. Farmers are interested in using organic fertilisers if the quality and price of the products are comparable to other sources of plant nutrients which include inorganic fertilisers and animal manure, and untreated waste water which is used on 36 percent of irrigated land in Nairobi (Hide and Kimani,2000). Compost production and urban agriculture are not necessarily linked to each other but efforts through the office of the Nairobi Provincial Agriculture will be rekindled so as to enhance nutrient recovery from the large mountains of organic waste especially around the wholesale markets. In Nairobi, the only urban farmers who used compost were those who had actively participated in the CBOs or who were given compost free. Therefore, besides information on product quality and price, awareness should also be raised among compost producers and users (for instance through media) how to obtain access to the compost.

Nancy Karanja and Mary Njenga

Storage and marketing of compost by City Park Environmental Group in Nairobi

Conclusion

Organic waste recovery for compost making offers numerous advantages, particularly to the urban poor, as it helps to improve food security through urban cultivation and to generate income through composting. The municipal councils of Nairobi and other towns in Kenya are unable to cope with the heaps of garbage that are found all over the place. Recycling of the organic material through compost making would not only generate highly needed soil amendment fertiliser and improved community incomes, but would also result in a cleaner and healthier environment.

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Waste Composting for Urban and Periurban Agriculture: Closing the Rural-Urban Nutrient Cycle in Sub-Saharan Africa
Drechsel, P.; Kunze, Dagmar (eds). 2001. 200 p. ISBN 0-85199-548-9. CABI, Wallingford, UK; IBSRAM Regional Office for Africa, Ghana; FAO Regional Office for Africa, Ghana
This CABI hardcover publication provides an African perspective on the potentials and constraints of urban waste recycling for soil amelioration (and integrated pest management) as well as for urban and periurban farming systems. Most of the papers here are derived from an IBSRAM - FAO International Workshop on Urban and Periurban Agriculture held in Ghana in August 1999

Reuse of Waste for Food Production in Asian Cities: Health and Economic Perspectives In: For *hunger-proof cities: sustainable urban food systems / Mustafa Koc, Rod Waste Recycling MacRae, Luc JA Mougeot and Jennifer .Welsh (eds), p. 136-144. ISBN 0.88936.882.1.*
This paper discusses health and economic aspects of the reuse of municipal waste in South and Southeast Asia. Recent research in Bangkok, Bandung, Bangalore, Hanoi, Ho Chi Minh City, Jakarta, and Manila is used to suggest the potential for linking organic waste reuse with urban agri-aquaculture.

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Allison, M., Harris, P.J.C.., Hofny-Collins, A.H. and Stephens, W. 1998. HDRA, Ryton Organic Gardens, Coventry, UK.P.34
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Municipal solid waste management, involving micro and small enterprises: guidelines for municipal managers.
Haan, Hans Christiaan; Coad, Adrian; Lardinois, Inge 1998. 154 p. ISBN 92-9049-365-8 ; USD 20. Publications Department, International Training Centre of the ILO, Viale Maestri del Lavoro 10, I-10127 Turin, Italy.
The focus of this publication is on micro- and small enterprises (MSEs) which have the advantage of appropriate technologies that can provide low-cost services at places where larger scale operations are either too expensive or make use of inappropriate equipment. At the same time, a number of restricting conditions that concern the extent to which SMEs can be involved in waste management operations is given. The current trend, the authors argue, is a mixed system of small and larger enterprises working together with municipalities.

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Klundert, A. van der, M. Muller, A. Scheinberg, N. Dulac, J. Anschutz and L. Hoffman. 2001.WASTE Advisers on Urban Environment and Development, Gouda, The Netherlands
This series of Tools for Decision-makers on Integrated Sustainable Waste
Waste Recycling Management (ISWM) presents a unique approach to municipal waste management. Integrated Sustainable Waste Management is a concept, an analytic framework and an assessment that pays attention to aspects often neglected in conventional municipal waste management. The series is based on lessons learnt in the Urban Waste Expertise Programme, a six-year research and pilot project programme (1995-2001) on urban waste in Africa, Asia and Latin America.

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www.sandec.ch
SANDEC is part of the Swiss Federal Institute for Environmental Science and Technology (EAWAG), Switzerland. Its activities centre on problems of sustainable development in economically less developed countries. Its mandate is to assist in developing appropriate and sustainable water and sanitation concepts and technologies adapted to the different physical and socio-economic conditions prevailing in developing countries.

www.waste.nl/uwep.htm
WASTE works towards sustainable improvement of the urban poor's living conditions and the urban environment in general. Its multi-year, multi-country programmes and projects have a focus on bottom-up development in relation to recycling, solid waste management, ecological sanitation and knowledge sharing. WASTE, located in the Netherlands, teams up with like-minded organisations in Africa, Asia, Latin America and Eastern Europe in implementing its activities.

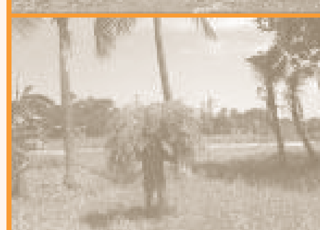
www.ecosan.nl
This is an important new site focusing on ecological sanitation. The site provides information on the technical, financial, environmental, health, socio-cultural, institutional, political and legal aspects important for the success of (ecological) sanitation. The site also offers practical examples of sanitation systems from around the world and provides further links to sites, publications and experts.

www.wastekeysheets.net
This site assists in making a Municipal Waste Management Plan, flexible and sustainable, by applying strategic planning and Integrated Sustainable Waste Management. The key-sheets are products of the project "Building Municipal Capacity for ISWM Planning" funded by DFID's KAR programme in which three municipalities were assisted in starting up the planning process for a municipal waste plan. The activities undertaken have been reworked into key-sheets offering hands-on support and information for planners in other municipalities.

Chapter 9

Wastewater Use for Urban and Peri-urban Agriculture

Wastewater is a resource of increasing global importance, particularly in urban and peri-urban agriculture. Wastewater is used for crop production, which includes fodder grasses, vegetables, cereals, ornamental plants, trees and flowers, timber crops and fruit trees, as well as for aquaculture and is often the only source of irrigation available. Wastewater use for irrigation generates livelihoods for farmers, agricultural labourers, produce transporters, market brokers and produce vendors. Consumers also benefit by obtaining access to fresh and cheap produce due to low transportation costs. To prevent potential negative impacts on human health and the environment, the importance of wastewater reuse in urban and peri-urban agriculture has to be recognised and clear policy guidelines for reuse need to be established. Careful research and awareness raising needs to be stimulated. Women play a key role in this context both as producers and in food preparation. Wastewater use in urban, peri-urban agriculture is a cross-sectoral issue that requires a multi-sectoral and multi-actor approach to research and planning.



Wastewater Use for Urban and Peri-urban Agriculture

Stephanie Buechler
Gayathri Devi Mekala
Ben Keraita

Introduction

Agriculture is often associated with rural areas, even though it has been practiced in urban and peri-urban areas since ancient times in backyards, on roof tops and road sides, in vacant plots and un-constructed areas, on river and lake beds and in other such small land lots. Urban and peri-urban agriculture (UA) provides nutrition and income, improves the urban environment by using the organic solid and liquid wastes of the city, provides aesthetic value to these areas and helps to achieve optimum land utilisation. However, city planners often ignore this important economic activity and do not include it in their planning. Agricultural finance institutions do not provide loans to urban farmers due partly to the fact that most of them do not have land titles and because the activity itself is considered insignificant. In addition to these factors that can hinder the success of UA, urban and peri-urban farmers often do not have access to a safe and reliable water supply. Issues related to this essential resource for agriculture are discussed in this chapter.

RUAF

Collecting water from a small pond

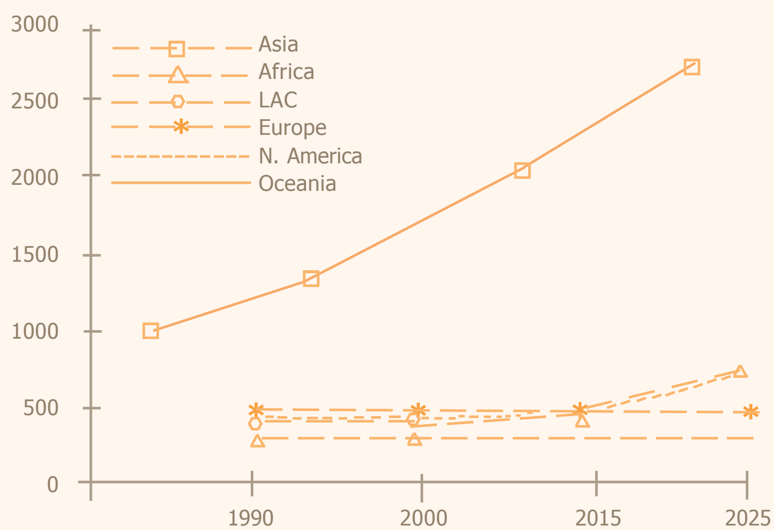
Increasing volumes of freshwater are being converted into domestic, hospital and industrial wastewater in rapidly growing towns and cities around the world. By 2015, the world will have one billion more people than it does now and 88 percent of this growth will be in cities, mainly in developing countries (UNDP 1998). This population growth will have a dual effect: 1) a substantial increase in the volume of urban wastewater produced, since greater volumes of surface and groundwater will be diverted to supply these burgeoning cities; and 2) an increase in urban demand for food. The increasing volume of wastewater will therefore be utilised by farmers on an even greater scale than at present. Particularly in the case of urban areas in semi-arid, drought-prone areas, the lucrative and large market for fresh produce and the urban water demand will make freshwater even more scarce. The use of wastewater for agriculture in and around cities across the world is a current and future reality that cannot be denied. In some countries, such as Mexico and China, it has been practised for centuries (Shuval et al., 1986). Since conventional treatment is very costly, most wastewater is allowed to be dumped, untreated, into water bodies or onto the land. Untreated wastewater use for urban and peri-urban agriculture is often either ignored or actively condemned by the public and by government officials.

There is a small but expanding set of literature on biophysical, social, public health, political and economic aspects of wastewater and its use for agriculture. These studies are being used to inform practitioners and policymakers of the reasons for the use of wastewater, the different types of wastewater (including raw, diluted, treated to primary/ secondary/ tertiary level), the likely increase in its use and possibilities for mitigating the multi-dimensional risks associated with wastewater and its use.

Freshwater Availability for Agriculture

As the world population increases, the competition for freshwater resources between domestic demands, industry, commerce, institutions such as hospitals, and agriculture is intensifying. Water demand has tripled since the 1950s (Brown, 2003). Figure 9.1 illustrates that increases in urban water supply coverage have been and will continue to be greatest in Asia followed by Africa, where absolute population figures as well as population growth are the highest (Scott et al., 2004). Imminent water shortages, however, are less likely to be visible than other natural resource disasters such as deforestation and soil erosion to both the public and policymakers. This is due to the fact that much of the water scarcity is induced by groundwater overdraft for agriculture, industry and domestic use made possible by increased electricity coverage, power subsidies for diesel and electricity, and the extension of cheap credit (Shah & Scott, 2004). A huge increase in the number of wells and over-pumping with increasingly powerful diesel and electrical pumps is leading to falling water tables. Particularly serious over-pumping is occurring in China, India, USA, Pakistan, Mexico, Iran, South Korea, Morocco, Saudi Arabia, Yemen, Syria, Tunisia, Israel and Jordan. Surface water from rivers is also tapped for freshwater and major rivers either completely dry up before reaching the sea or contain only a very small volume of water. Such over-exploited rivers include the Colorado river, the Yellow river, the Amu Darya, the Nile, the Indus and the Ganges. Currently, 70 percent of surface and groundwater is used for agriculture, however with increasing competition between agriculture, industry and domestic demand, agriculture is beginning to receive less water (Brown, 2003).

Figure 9.1 Growth in urban water supply coverage by world region



Source: Scott et al., 2004

Water reuse is not a new phenomenon; it has been a worldwide practice for centuries. Agricultural wastewater, sewage wastewater (including grey water and black water) and industrial wastewater have been used directly or after treatment and/or dilution in urban and peri-urban areas for agriculture, especially in drought years. With the dwindling supplies of fresh surface and groundwater, water reuse and recycling assumes a greater role than before to keep up with the increasing population growth and the demand for increased quality and additional quantities of food.

Wastewater Production by Growing Cities

The quantities of wastewater produced by cities are rising steadily with urban growth. As cities grow, the water supply to these cities also grows, resulting in ever-increasing quantities of wastewater produced by urban residents and industries. Municipalities, farmers, and irrigation and agriculture departments are ill-equipped, however, for the very sharp rise in urban-rural water transfers (Buechler and Scott, 2006). The sources of wastewater include sewage drains, storm drains used as sewage channels, surface water sources like rivers, lakes and natural streams polluted with wastewater from city sewage and drainage channels, ponds and tanks, shallow wells, house drainage spouts and channels, wastewater treatment plants etc. The composition of the wastewater varies according to its origin. There is storm water and other urban run-off, grey water (domestic water that is wastewater without urine and faeces) or black water (domestic wastewater with urine and faeces), industrial wastewater, wastewater generated by hospitals and other institutional/ commercial establishments and combinations of all of these (each with varying concentrations of waste). The volumes of wastewater generated in Asia in the late 1990s are seen in Table 9.1. An example of urban growth far exceeding the capacity of sewage collection and treatment is Delhi, India. Only about 40 percent of the capital city of Delhi has sewerage at present, and of that less than half actually delivers sewage for treatment. Most is simply channelled through open drainage canals to the main river (the Yamuna) untreated. Despite investments in new treatment plants, the growth rate of the city is so rapid that progress in proportion to this growth has been very slow (Ganges River Partnership Project, 2002).


WMI-Ghana

Domestic wastewater used for vegetable production in Accra

According to the United Nations Economic and Social Commission for Asia and the Pacific and the International Water Management Institute (IWMI), wastewater treated to primary or secondary levels is used for irrigation, in industry and cooling, whereas untreated wastewater is used mainly for agriculture. Wastewater treatment is costly, and even those cities that are currently able to procure funding to build treatment plants only treat a small percentage of the total volume of wastewater. The rest is left to flow into natural water bodies. Most of the water only receives primary treatment. The majority of developing countries treat less than 15 per cent of the wastewater they produce (Davis & McGinn, 2001). Many treatment plants in cities in the South go into disuse after a short period of time due to insufficient funds for operation and maintenance. This is the situation in cities like Vadodara, the third largest city in Gujarat state, India, where none of the three treatment plants is fully functional (Bhamoriya 2004); in Kathmandu, Nepal, where many of the valley's treatment plants are in poor condition (Rutkowski et al., n.d.) and in Cochabamba, Bolivia, where the one treatment plant that exists is overloaded and therefore not working properly, and most residential septic tanks and Imhoff tanks are not functioning (Huibers et al., 2004). The percentage of the population with full water-borne sewerage connections in sub-Saharan African is very low. Harare, Zimbabwe, is one of the cities in Sub-Saharan Africa with the highest coverage while Lagos, Nigeria, has one of the lowest. In Lagos (Nigeria), Africa's largest city, with a population of 10 million, only 5 percent of its population is connected to the sewage system and treatment of sewage is below recommended standards. Only 2 percent of the cities in sub-Saharan Africa have sewage treatment, and only 30 percent of these systems are operating satisfactorily. In Addis Ababa, with a population of 2.5 million, the sewage system serves only 35,000 people (www.unep.or.jp).

Table 9.1 Estimated volumes of wastewater (million m^3/year) in Asia

Country	Sewage in urban areas	Industrial effluents	Total wastewater
Bangladesh	525	200	725
Bhutan	3.9	0.3	4.2
China	37 290	22 672	59 962
Hong Kong, China	NA	NA	840
India (23 metropolitan cities only	3 250	140	3390
Islamic Republic of Iran	2 000	600	2600
Japan	NA	NA	17100
Kyrgyzstan	83.8	21.6	105.4
Malaysia	1 400	2.9	1 402.9
Maldives	3.7	0	3.7
Mongolia	NA	NA	82.9
Myanmar	16.6	0.5	17.1
Pakistan	NA	NA	NA
Philippines	7 500	NA	NA
Republic of Korea	5 939	956	6 895
Singapore	NA	NA	470
Sri Lanka	350	225	950
Thailand	NA	NA	NA
Turkmenistan	268	913	1 181
Uzbekitsn	1 083	4 580	5 663
Vietnam	540	350	890

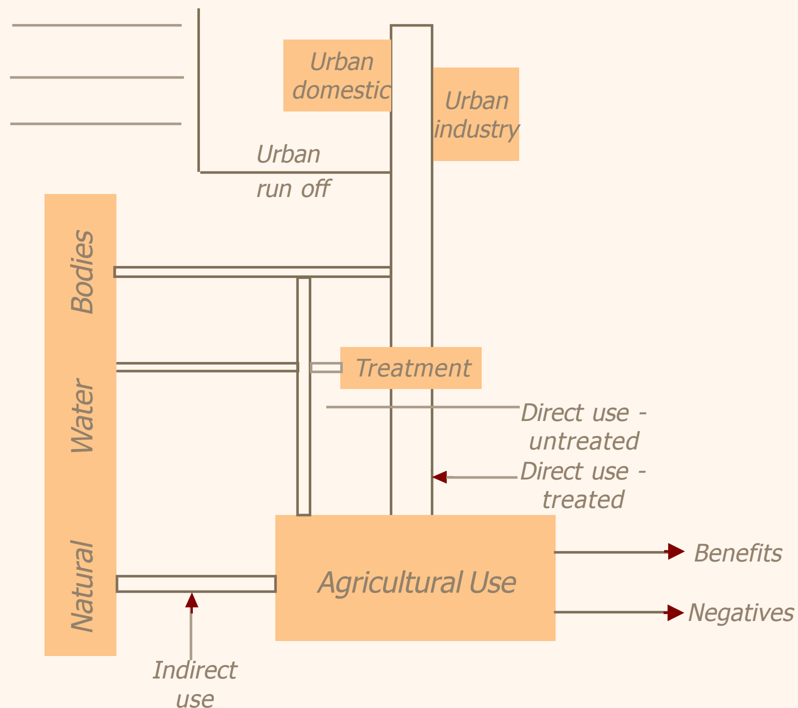
Source: Economic and Social Commission for Asia and the Pacific. 2000.
NA means, not available

Policymakers' current focus is on wastewater regulation and treatment. However, to make realistic policies, information must be gathered on where wastewater irrigation takes place, the reasons for and extents of its use, the socio-economic characteristics of the main actors deriving direct and indirect livelihood benefits from this use, the risks to livelihoods and human and animal health of this use and the different types of wastewater use. A common typology of wastewater use that addresses aspects such as direct use (i.e. 'end-of-pipe' sewage irrigation), dilution of wastewater with natural surface water before use, and the relative contributions of domestic wastewater, industrial effluent, and storm water to urban wastewater is required. Van der Hoek (2004) has developed a typology (See Figure 9.2) that categorises wastewater use into three types: direct use of untreated wastewater where wastewater is directly applied to land from a sewage system; direct use of treated wastewater where treated wastewater is channelled to a particular area for irrigation; and indirect use of wastewater where wastewater is taken from another receiving water body such as a pond, lake, canal, tank or river.

Wastewater Use in Urban and Peri-urban Agriculture and its Contribution to Livelihoods and Food Security

Urban and peri-urban farmers from different caste and class groups in developing countries in Asia and Africa derive their livelihoods by using wastewater for various activities such as horticulture, fodder production for dairy activities, agroforestry, orchard keeping, floriculture, aquaculture and cereal production. There are also many areas in which the government runs sewage farms near treatment plants which are hired out to farmers for cultivation such as those around Madurai, South India (documented by Chandran et al., 2003) and around Hyderabad, India (Buechler & Devi, field observations).

Figure 9.2 Basic types of wastewater use



Source: Wastewater Typology developed by Wim van der Hoek, IWMI (2004)

To date, assessments of the extent of wastewater irrigated areas have been carried out in Pakistan, India, Vietnam, China, Mexico and Jordan. In Pakistan an IWMI study estimated that there were 32,500 hectares irrigated directly with wastewater (Ensink et al., 2004). Strauss and Blumenthal (1990) estimated that 73,000 hectares were irrigated with wastewater in India. However, Buechler and Devi (2002) estimated that just only along the Musi river that runs through Hyderabad city in Andhra Pradesh state and the canals and tanks off this river approximately 16,000 hectares of land is irrigated with urban and industrial wastewater (2003). An estimated Rs 1 million per day at least (personal communication by IRDAS, the NGO) is generated due to wastewater irrigated urban agriculture in Hyderabad. In the down stream of Vadodara, third largest city in Gujarat, India, alone, wastewater supports annual agricultural production of Rs 266 million (US $ 5.5 million) (Bhamoriya 2004). In Ghana, it was estimated that if just 10 percent of the 280 million m^3 of wastewater from urban Ghana could be (treated and) used for irrigation, the total area irrigated with wastewater alone could reach 4600 ha. At an average dry season farm size of 0.5 ha, this could provide livelihood support for about 9,200 farmers in the peri-urban areas of Ghana (Agodzo et al., 2003). In Vietnam, at least 9,000 hectares of land were found to be irrigated with wastewater mostly to grow paddy, and in and around 93 percent of the cities wastewater is used in agriculture or aquaculture (Rachid-Sally et al., 2004). Mara and Cairncross (1989) estimated that 1.3 million hectares were irrigated with wastewater in China. For Mexico, estimates of the number of hectares irrigated with wastewater vary greatly between studies. Castelán has estimated the number irrigated with domestic wastewater at 344,000 ha, but states that in 1997, 403,000 ha of restricted crops (i.e. crops that are illegal to grow with wastewater as the produce is eaten raw) were cultivated (2000:25). Scott et al., 2000) has put the number at closer to 500,000 ha.

Wastewater used for vegetables without prevention

Wastewater users, who come from a wide range of socio-economic backgrounds, have a variety of motives for using wastewater for irrigation. In semi-arid and arid areas it is often the only source of water available in sufficient quantities for irrigation; it is also available year-round unlike freshwater from rainfall which is concentrated in the often short and sporadic rainy season. It is also an inexpensive source, not only of water but also of nutrients. In fact, farmers often need few or no additional fertilisers. Crop yields are often higher with wastewater than with freshwater. For example, in Haroonabad, Pakistan, it was found that wastewater farmers earn $US 300–600 more per year than non-wastewater farmers and that the majority of wastewater farmers were landless and leased in land for agricultural production (van der Hoek et al., 2002). In Kumasi, Ghana, Danso et al (2002) found that urban market farmers can earn 2-4 times more than farmers who grow maize and cassava. Wastewater farmers in and around Kumasi earn an average of US$ 340/ha per season (Cornish and Kielen, 2004). Wastewater can easily be channelled to the fields from city drains, from a river, or from broken sewer lines or carried to the fields in watering cans. Using this water is also attractive as UA fields are often conveniently located near city markets where the produce is sold, or are near urban-based buyers who purchase the produce directly from the (peri-)urban plots. As urban populations and incomes of the urban residents increase, so too does the demand for fresh vegetables and dairy products (Brown, 2005). Often, nearly all of the perishable produce for urban consumption is grown in and around urban areas due to the lack of refrigerated transportation in cities. For example, 90 percent of the lettuce and spring onions consumed in Kumasi, Ghana, are produced in the city itself (Danso et al., 2002).

Despite the widespread use of wastewater, municipalities and water boards underestimate its value, and for policymakers it is a non-issue. The lack of information and awareness both among producers and consumers about the inherent risks of wastewater use further compounds the problem. The difficulties faced in wastewater use for aquaculture relate to the non-availability of guidelines for selection of species and stocking density (Kaul et al., 2002:3). The compatibility of the reclaimed water with its intended usage is an important consideration in developing a wastewater reuse system. Higher level uses such as for irrigating public access lands (eg. Parks) and the cultivation of vegetables requires higher levels of treatment compared to lower level usage such as pasture maintenance, floriculture and agroforestry irrigation.

Impact of Wastewater Irrigated Urban and Peri-urban Agriculture on Health

Fifty percent of all children in developing countries (10.4 million children) under the age of five die per year due to malnutrition (Rice et al., 2000, WHO, 2000). Healthy individuals make healthy communities and wastewater, if well-managed, can help alleviate malnutrition especially for children of poor households. According to the draft WHO report 2005, "Guidelines for Wastewater Use in Agriculture" wastewater use in agriculture may have important economic benefits for households and communities that can improve the health of families through better access to healthcare, education, nutritious food and improved access to both water and sanitation in the household. In Hyderabad, a wastewater reuse case study showed that vegetable producers in the urban and peri-urban areas save about 20 percent of their household expenditure which they would otherwise have spent on the purchase of vegetables. Most of the households with livestock in the urban and peri-urban areas of Hyderabad, India, use wastewater irrigated para grass as fodder and generate an income through the sale of the milk. Typically, 25 percent of the milk produced (assuming a household of 6 members owns one buffalo) is retained for household consumption and 75 percent is sold (Buechler et al., 2003c). The Hyderabad and Kumasi case studies further elaborate on these topics.

On the one hand, wastewater can contribute to improved health of poor communities through income generation and increased access to food. On the other hand it can be associated with a number of health risks since most wastewater is untreated or contaminated with industrial and other wastes.

Negative impacts on farming families and local communities

The people who face potential risks from the use of wastewater for agriculture are agricultural field workers and their families, crop-handlers, consumers and those living near irrigated fields. Wastewater can have direct and indirect health impacts. Direct contact with untreated wastewater through flood or furrow irrigation can lead to increased helminth infection (mainly Ascaris lumbricoides -roundworm, Trichuris trichiura -whipworm, Ancylostoma duodenale and Nector americanus - hookworm). Two case studies that examined the impact of untreated wastewater on health, environment and income in Pakistan indicated higher hookworm infections in farmers and farm workers who use wastewater for irrigation than those who do not (Ensink et al., 2004).The main risk for the public arises when vegetable or salad crops grown with untreated wastewater are consumed raw. This can be linked to cholera and typhoid as well as to faecal bacterial diseases, bacterial diarrhoea and dysentery among consumers of wastewater-irrigated produce. Municipal and industrial wastewater is a major source of chemical pollutants that could affect human health. Chemical contaminants that pose potential health concerns and identified in untreated wastewater are shown in Box 9.1.

IWMI-Pakistan

Wastewater can be valuable because of the bad quality of groundwater

Strategies for Managing Health Risks

There is no single solution to the problems mentioned above. Combinations of different strategies that can reduce the health risk to humans need to be adopted. Pathogens and other inorganic contaminants in the fields do not necessarily represent a health risk if other suitable health protection measures are taken. The different health protection strategies as per the draft WHO report 2005 (currently being tested), "Guidelines for Wastewater Use in Agriculture" are:

Wastewater treatment: Most conventional domestic wastewater treatment plants focus on the removal of environmental pollutants (eg. suspended solids, BOD - Biochemical Oxygen Demand-, COD - Chemical Oxygen Demand -, etc.) but not on pathogens, as the latter is more difficult and more costly and therefore not easy to undertake in developing countries. For the quality of treated water to meet the WHO standards, secondary treated water needs to be supplemented by tertiary treatment (disinfection) or retained in a maturation pond for five more days. Some research has been done to develop decentralised and cheaper treatment solutions. One example is the pilot project, "Ecology and Development with Sustainable Sanitation" (ECODESS) of the Urban Development Institute in the district of San Juan de Lurigancho near Lima, Peru. In this arid urban area on the Peruvian coast, where freshwater availability per person per year is projected to be five times less than the global average by 2025, and only 4 percent of the sewage is currently treated, this project has set up a household and a community system to collect, treat and recycle wastewater. The treated wastewater is channelled into an underground irrigation network for use in green areas and urban agriculture (Calizaya, 2002). Another economical model in Kolkata, India, for improving the quality of wastewater used in peri-urban aquaculture is the cultivation of dense plantations of crops or trees on the sides of wastewater canals, which controls soil erosion, absorbs some amount of the pollutants and provides nutrient-rich water for aquaculture (Mukherjee, 2003).

Box 1 *Selected chemicals of potential health concern identified in untreated municipal wastewater**

Chemical	*Potential health effects*
Heavy metals	
Arsenic	*Gastrointestinal, skin, and nerve damage, cancer*
Cadmium	*Gastrointestinal, kidney and lung damage*
Chromium	*Lung and skin damage, cancer*
Lead	*Nervous and immune system and kidney damage*
Mercury	*embryo/fetotoxic*
Nickel	*Brain and kidney damage, embryo/fetotoxic*
	Lung, brain, kidney, liver, spleen and skin damage, cancer
Inorganic chemicals	
Cyanide	*Brain and heart damage, shortness of breath, death*
Fluoride	*Dental and skeletal fluorosis*
Hydrogen sulphide	*Nausea, vomiting, mucous membrane irritation*
Nitrate	*Methaemoglobinaemia*
Nutrients	
Nitrogen	*Cause eutrophication which facilitates the growth of toxin-producing*
Phosphorus	*cyanobacteria and other harmful algae*
Organic chemicals	
Benzene	*Anaemia, dizziness, leukaemia*
Phenol	*Irritation of skin, eyes, and gastrointestinal tract, systemic*
Toluene	*toxicant*
Xylene	*Brain and kidney damage*
	Confusion, dizziness, memory loss, embryo/fetotoxic
Other chemicals	
Endocrine disruptors	*Reproductive/developmental effects in wildlife, various potential effects in humans*
Pharmaceuticals	*Reproductive/developmental effects in wildlife, various potential effects in humans*

* The toxicity of a chemical depends on its concentration, the route of exposure to the chemical and the duration of exposure to the chemical. The health effects above include both acute toxicities (high chemical concentration and short exposure duration) and chronic toxicities (relatively low chemical concentration and long exposure duration) with all routes of exposure. Some of the toxicities may not be applicable to wastewater.

Sources: Chang, Page & Asano, 1995; National Research Council, 1998; WHO, 1999; WHO, 1992; WHO, 1991; WHO, 1989; ATSDR, 2000.

Choice of irrigation techniques: Farmers use different irrigation techniques depending on convenience and knowledge. However, farmers using wastewater for irrigation need to take some precautions during irrigation. Sprinkler/spray irrigation has the highest potential to spread bacterial and viral diseases and hence a buffer zone of 50–100 meters from houses or roads should be maintained to prevent health risks to local communities. Workers in the fields and their families should wear protective clothing in case of furrow or flood irrigation to prevent direct contact with wastewater. Localised irrigation techniques like bubbler/drip/trickle offer the best health protection but are expensive to implement. Still for all, drip irrigation is being taken up by some farmers as seen in Cape Verde and India (FAO 2001; Kay 2001). Vaz da Costas Vargas et al., (1996) show that cessation of irrigation for 1-2 weeks prior to harvest, wherever possible, can be effective in reducing crop contamination.

IWMI-Ghana

Simple techniques can be used to prevent pollution

Crop Selection: Water of poorer quality can be used to irrigate non-edible crops such as cotton or flowers, or crops that are cooked before consumption. Plants (eg. zucchini) with rough, textured surfaces, deep crevices or hairy surfaces that grow close to the ground may harbour bacteria or contaminated soil and should be avoided. But crop restriction cannot be a stand-alone solution. In Chile, the use of crop restriction, when implemented together with a general hygiene education programme, reduced the transmission of cholera related to the consumption of raw vegetables by 90 percent (Monreal, 1993).

Human exposure control: Field workers are the most exposed to wastewater. The health risks faced by these individuals can be reduced by using appropriate irrigation techniques such as bed and furrow cultivation and protective clothing in the form of boots and gloves (van der Hoek et al 2002; Ensink et al., 2004). Field workers should also be provided with sanitation facilities and drinking water. Provision of safe water in vegetable markets to wash produce is important to prevent further contamination of wastewater irrigated agricultural products. Consumers should wash fresh produce thoroughly and cook it before use. Governments should invest in employing additional health inspectors who do periodic checks on milk and meat products in the city. Finally, awareness campaigns on these issues would be of great help in minimising the health hazards of wastewater irrigation.

Treatment with chemicals and Vaccination: Immunisation against typhoid and hepatitis A for highly exposed groups is recommended (Carr et al., 2004). This therapy for adults and children in particular at regular intervals can reduce helminth infections (Ensink et al., 2004).

Developing alternatives: Improvement of sanitation, or use of innovations in the existing sanitation systems. One such innovation is Eco-Sanitation (see Box 9.2).

Farmer Innovations to Deal with Poor Water Quality and Degraded Soils

Farmers have developed a variety of different innovations in order to adapt to deteriorating water quality and degraded soils. In order to maintain or increase yields and income and to lower their health risks, they continuously react to changes in water quality and quantity and soil productivity. Some examples of farmer innovations are the mixing of groundwater and wastewater (see Buechler and Devi, 2005; Faruqui et al., 2004; Raschid-Sally et al., 2004;

Ensink et al., 2002) and alternating the use of groundwater and wastewater according to the stage of plant growth (Buechler and Devi 2005). These strategies were found to increase yields, decrease pest attacks as well as decrease worm infections among wastewater irrigators and other agricultural labourers. Another adaptation made by farmers is in switching to new crops that are more suited to wastewater irrigation, for instance replacing paddy with fodder grass as it is more tolerant to higher levels of salinity, as is the case in wastewater (Buechler and Devi, 2005).

Box 9.2 *Ecological sanitation*

Ecological sanitation is a safe method of recovering nutrients from human excreta, then recycling them back into the environment and productive systems

A human being produces in the form of excreta exactly the amount of nutrients that is needed for growing his or her food (measured in crops) – 7.5 kg of nitrate, phosphorus and potassium for 250 kg of crops. Urine hardly contributes at all to the spread of diseases (eg. bilharziasis) and contains approximately 88 percent of the nitrogen, 67 percent of the phosphorus and 71 percent of the potassium carried in domestic wastewater. Faeces contain 12 percent of the nitrogen, 33 percent of the phosphorus, 29 percent of the potassium and also 46 percent of the organic carbon, as well as most of the pathogens.

If separated, urine can easily serve as a fertiliser after it has been diluted with water. After faeces have been desiccated (dried-out), they are free from pathogens, diseases and odour. They can then serve as a soil conditioner for agriculture, returning a significant part of the nutrients and trace elements to the soil.

The remaining treated grey water may be used for irrigation and also for recharging the local aquifer. This closes the local cycle, helping to improve food security and to conserve soil fertility. At the same time, human health is improved due to the removal of disease sources from the domestic environment.

Source: http://www.thewaterpage.com/ecosan_main.htm

Users' Needs and Perceptions

Farmers' perceptions on the different aspects of wastewater - quality, economic value and health issues – should be brought to the attention of policymakers and urban authorities in fostering appropriate planning initiatives. By farmers we mean members (female and male of different ages) of farming households who carry out activities related to the production of crops using wastewater for irrigation. By focusing on the perceptions of members of these farming households, the different needs of wastewater-dependent households living in different locations and belonging to different socio-economic strata will be elucidated (Buechler 2004). Other factors that vary across locations and affect users' needs are: the sources of the wastewater and percentage of industrial effluent mixed with domestic sources; the *de jure* and *de facto* land tenure system; land values, land rental rates and land taxes; infrastructure (electricity grid); and the legal framework. Gathering and analysing farming household members' perceptions can facilitate the formulation of flexible "response scenarios". These could be developed for specific locations or for similar localities to identify appropriate risk reducing strategies that are technically, economically, socio-culturally and politically compatible. Users' perceptions of wastewater use have received only scant attention in studies to date.

One strategy to bring the perceptions and voices of wastewater users to various audiences is through documentary films (see Buechler et al., 2003a). In order to integrate users' perceptions into written media, their responses to key questions regarding wastewater use for agriculture must be elicited, recorded and then transcribed. Selections from the transcriptions must be incorporated into the written text of articles and other written and visual outputs and disseminated to key actors and decision-makers who will use them to develop projects and policies as an integral part of other urban planning initiatives. Newspapers, television and radio are the most popular media in most countries and can be used to disseminate information to producers and consumers. For policy makers, fact sheets and policy briefs can be developed and distributed. School children can be given educational tours to make them aware of the environmental hazards of disposing organic and inorganic wastes in water. Women can be specifically be targeted for education on the importance of cleanliness during food preparation to prevent possible infections (i.e by washing away helminth eggs), further contamination of wastewater produce and proper cooking of food.

Gender Issues

The experiences and roles of women and men in UA are gender related (see also chapter 5). Frequently, different agricultural tasks such as weeding, irrigation, harvesting and post-harvest activities that include making bundles, threshing, washing of produce, marketing etc. are divided by gender. In wastewater-irrigated agriculture, a gender division can also be discerned in the types of crops produced by men and women. The gender division of labour is context-specific. For example, in and around Hyderabad, India, mainly women are involved in both the cultivation and sale of leafy green vegetables in the surrounding wastewater-irrigated fields (Buechler & Devi, 2002; Buechler et al., 2003a). However, in and near the city of Kumasi, Ghana, most of the vegetable production is done by men while the marketing is done mainly by women (Keraita et al., 2002). In Haroonabad, Pakistan, vegetable cultivation is mainly done by women and marketing of the produce mainly by men (van der Hoek *et al* 2002; Ensink, personal communication November 2004). In and around Hyderabad, it was evident that women benefited in a myriad ways from wastewater-irrigated leafy green vegetable production; they benefited from the income derived from the sale of their produce and from improved nutrition for themselves and their household members. Women and children benefited also through employment created on the vegetable fields. Vegetable vendors in urban and peri-urban markets, who are mainly women, benefited through their income from sales as well as through keeping some of the vegetables for home consumption or bartering these vegetables for other types of produce sold in the market (Buechler & Devi, 2003d). Women play an important role in animal husbandry in urban and peri-urban areas in South and South-East Asia and in Latin America. Most activities associated with dairy production, for example, are performed within the domestic compound and are therefore done mainly by women, whose public space is often restricted by patriarchal social norms (Devi et al., 2004). Fodder for these animals is often procured from wastewater-irrigated fields. Studies on wastewater use for UA and wastewater irrigation need to include gender as a variable. For example, very few studies on health risks associated with wastewater use have examined the particular risks of women versus men, or girls versus boys. Women and girls spend more time in vegetable fields in many regions of the world than men and they perform tasks such as weeding which involves direct contact with the soil and, after irrigation, with water. Many are landless, migrant field labourers with little or no access to health care services. Women's access to and control of resources is also limited in most Asian and African countries. However, it has been seen that women have greater bargaining power when they are organised as groups. Through cooperative mechanisms, women can pool resources, information, time and energy,

Sabine Gerstl

Drawing water out of a well, Tanghin, Ouagadougou thereby increasing their chances of developing successful livelihood strategies in urban agriculture (Wilbers, 2004).

Very few studies have focused on livelihoods of urban and peri-urban vegetable market vendors, who are predominantly women in regions such as Latin America (an exception is Brazil), Africa and South Asia. Many of these women depend on wastewater-irrigated crops for their income and household food security (Buechler & Devi, 2003c). Yet little is still known about the ramifications of deteriorating wastewater quality on the sustainability of vegetable production and sale in and around urban areas.

Education, Information and Awareness-raising

Raising awareness among farmers, policymakers, polluters, people on the market, consumers and other stakeholders is seen by many as the immediate and most important strategy to reduce the health risks associated with wastewater farming in most low-income countries.

Education and information sharing need to be tailored to each type of group that engages in wastewater dependent activities, as the user patterns of each set of actors is very different. IWMI Hyderabad has developed a series of posters translated into several local languages for dissemination to farmers (see Figure 9.3) and a documentary film on wastewater use and users. Consumers are also a heterogeneous group, using different types of wastewater-produced items. Producers, workers and consumers need to be included in information campaigns, training and information-sharing forums, so that hygiene can be improved and associated diseases prevented. Municipal authorities often do not include urban farmers as "real irrigation farmers" and therefore do not provide any extension services to them (see the Kumasi case). Awareness raising could diminish risks related to wastewater irrigation and possibly have a wider impact in combatting hygiene-related diseases in general.

As the Hyderabad Declaration states, wastewater use for livelihood activities in urban and peri-urban areas is a reality that planners and policymakers must face. Financial resources should be made available to the relevant institutions to implement appropriate measures to protect and support these livelihoods as well as to improve the health of the environment, the users and the consumers.

Institutions

Various governmental agencies are involved in shaping the policy framework into which wastewater-related activities are incorporated. Often, there is little convergence between the laws and policies of these different institutions in relation to UA and wastewater use. Enforcement of laws such as those related to the environment is often lax (Raschid et al., 2004b). Wastewater farmers often face a hostile legal and institutional environment of fines and imprisonment (Keraita & Drechsel, 2004; Buechler & Devi, 2002). Sometimes institutions even compete for the rights to allocate and/or sell wastewater (Bhamoriya, 2004; Buechler 2001). There is a need for researchers, NGOs and urban farmers to engage with policymakers at various levels and officers from various different governmental agencies to encourage a well-integrated, supportive policy environment. Poverty reduction programmes could integrate the needs of urban and peri-urban farmers such as for land tenure security and health and agriculture-related training. There is also a need to strengthen local institutions such as farmers' associations and institutions involved in sewage collection and low-cost treatment systems, and to enact by-laws that can enhance safe urban vegetable (see the Kumasi case) and other agricultural and aquaculture-related production. Membership in local institutions related to wastewater use for agriculture may be limited to those who own land. Separate institutions may exist for people of different caste, class, religion, gender and ethnic affiliations. These divisions and affiliations in membership and organizational type

Figure 9.3 Poster on risks and benefits of wastewater use

WHAT MEASURES CAN ALLOW WASTEWATER USE TO GIVE YOU AN INCOME?

In the urban, peri-urban and rural areas near Hyderabad along the Musiriver, wastewater is being used by farmers for the cultivation of various crops which in turn contributes to their livelihood and food security.

GROW CASHCROPS

Para grass when planted can be harvested for more than 20 years without replanting. You can also grow banana, coconut, leafy vegetables and jasmine. Para grass and jasmine have high returns, through the year and pose the lowest health risks.

IMPROVE LIVELIHOODS

Wastewater can be used for livestock rearing, fisheries and toddy production.

Grow mulberry trees to rear silkworms for cottage Industries. Increased employment in para grass cultivation generates income throughout the year.

MAKE PROFITS

Rent out land for fodder, leafy vegetable cultivation or grazing and reap the returns. Employment opportunities exist for those who cut para grass or transport it to markets.

ENSURE PROTECTION AGAINST HEALTH RISKS

The activities listed above are environmentally acceptable and pose the least health risks to humans.

If you would like to know how you too can get the maximum benefits from wastewater reuse, contact :

International Water Management Institute (IWMI),
C/o ICRISAT, Patancheru 502324,
Andhra Pradesh

This project was initiated by the International Water Management Institute (IWMI) with support from the U.K. Department for International Development (DFID) and was implemented by IWMI in the Musi River area, Hyderabad, Andhra Pradesh shape the constraints and opportunities faced by wastewater users (Buechler, 2004). Linkages between organisations should be encouraged to strengthen them, as is currently being done in RUAF's Multi-stakeholder Action Planning and Policy-making process. Efforts should be made to give membership to wastewater users in local institutions who have been denied this right due to their status; or else they should be accommodated in new organisations. Laws prohibiting urban agriculture or the failure of governments to respect current land tenure rights allow temporary land use that can harm the livelihoods of wastewater farmers. Laws and by-laws that support urban and peri-urban farmers and those that make a living off of wastewater produce can and need to be enacted. A key feature of the RUAF-CFF project (2005-2008) is to bring all the relevant stakeholders to one platform to encourage linkages and symbiotic association and to develop integrated, comprehensive plans.

Conclusions

Many challenges lie ahead for wastewater users involved in UA around the world. The rapid expansion of urban development will bring opportunities in terms of increased water supply for irrigation in the form of wastewater and a greater urban demand for their products. The demand will increase mainly in certain niche products for which consumers are ready to pay a premium on the freshness of the product, for example, milk, meat, fresh vegetables and fruits. However, overall land availability may decrease with urbanisation and agricultural land will certainly shift to areas that are further away from city centres. The quality of wastewater may well deteriorate if urbanisation takes place with concurrent increases in industrial, hospital and commercial effluents. Urban authorities in water and sanitation agencies, health care agencies, agriculture ministries, urban and industry planning agencies, development and welfare agencies will need to ensure that investments are made in relevant initiatives. These include domestic, hospital, commercial and industrial wastewater source separation and treatment options; promotion of water pollution prevention management techniques and technologies; provision of incentives for industries to reuse water and to use less water to minimise water pollution; preventive and curative health care measures; farmer extension services for both female and male urban wastewater farmers and farmer-to-farmer exchanges; and social programmes designed for each category of wastewater-dependent group (male and female landless labourer, land leaser, landowning farmer etc).

There are many gaps in wastewater research which hinder attempts by policymakers and practitioners to identify solutions to common problems faced by wastewater users. One such gap is the lack of knowledge of how wastewater users adapt to changes in wastewater quality and quantity over time. Innovations and adaptive mechanisms developed by farming households can be shared with other farmers in similar circumstances; these local innovations can be further refined and adapted by social and natural scientists in relevant institutions for developing effective, context-specific risk-mitigation strategies that can be promoted by governmental and non-governmental institutions. Another gap in current research is the lack of clarity on which social groups are involved in wastewater-irrigated agriculture and why. Without this information, policies and programmes that cater to the special needs of each group cannot be developed. The main risks and benefits for groundwater users in wastewater-irrigated areas are also not well understood and needs the attention of biophysical as well as social scientists. Lower-cost treatment options need further research in order to increase the capacity of urban sanitation authorities to manage their waste in a sustainable manner.

A major obstacle in the process of minimising the risks lies in the non-recognition of wastewater reuse and urban agriculture as an urban livelihood strategy. Wastewater is not a priority issue for policy makers and there is no coordination among the different institutions – municipalities, water boards, departments of agriculture, and departments of land use planning, quality control agencies – that have a stake in wastewater use. This inhibits the design of integrated solutions. The adoption of research programmes and risk-mitigation measures or enabling policies therefore depends on whether the authorities and policymakers give due recognition to urban agriculture. This will also ensure that sound legal and regulatory frameworks related to urban agriculture are sustained and enforced.

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The Use of Polluted Water in Urban Agriculture: "Livelihood realities and challenges"

Ben Keraita
Pay Drechsel

Why is Low-quality Water used in Irrigated Agriculture?

Wastewater treatment in most high- and middle-income countries is associated with conventional treatment systems. The efficiency of these systems is indicated by the percentage of households covered by sewerage and the number of operational wastewater treatment plants. In Ghana, where domestic effluents are the main sources of wastewater, less than 5 percent of households are served by sewerage, and all of them in urban areas. In other words, the efficiency of wastewater treatment is very low.

IWMI Ghana

In Kumasi the majority of the irrigators are men

Another common sanitary indicator is the use of public toilets and septic tanks that are emptied and treated in faecal sludge treatment plants. Currently, there are 44 treatment plants (sewage and faecal sludge) in the country but most of them are small, privately-owned and almost all are in poor operational condition. Massive quantities of untreated wastewater therefore end up in urban storm water drains and in the natural drainage system, i.e. streams and rivers. In Ghana's growing cities and downstream of them, people depending on stream water for domestic or agricultural purposes are increasingly challenged by water pollution. Farmers emphasise that (land with) water close to markets and especially in the dry season is a rare resource, but one that sustains their livelihoods (Keraita et al., 2004). In fact, many of the 12,000 farmers involved in dry season vegetable farming in peri-urban Kumasi (Cornish et al., 2001) farm near polluted rivers and streams.

While all of the local authorities clearly recognise the challenge of providing adequate sanitation and the environmental problems, there is little that they can do due to lack of public funds. A common goal in urban wastewater treatment is to achieve a given standard, usually adopted from developed countries. For a developing country such as Ghana, Grau (1994) and Gijzen (1997) have shown that it is, however, simply unrealistic to achieve such a standard, considering the imbalance between the economic requirement and the available municipal budget. Surveys across major cities in Ghana confirm this proposition.

Livelihood Realities

Perception studies with farmers, sellers, authorities, consumers etc., have shown a general awareness among them about the low water quality, although the fact has not received much attention from any of the said groups. The question is why?

Water quality monitoring studies show that some irrigation water sources have very high faecal coliform levels (10^7-10^9/100 ml). These levels are comparable to that of raw human faeces, and are attributed to the dumping of raw faecal sludge into streams. One such stream is Abuabo, in Kumasi, from which Baba gets water for his vegetable farming. During the interviews, Baba said, "*My father used to farm here and I continue to do the same. This is my only* *livelihood source, as I can get money from my sales to buy food for my family, educate my children and for other purposes"* Baba could not disclose how much he earns, but studies have shown that on small plots, urban market farmers make up to USD 400-800 annually, especially during the dry season (Danso et al., 2002). This is 2-4 times the income derived from traditional maize-cassava farming on much larger plots. Baba farms on a 0.2 ha, belonging to the government and he does not pay a rent for it. He said that many youth are also taking on this activity due to lack of jobs in the city while others do it to supplement their income. Referring to the quality of the water, Baba said, " *…I know that this water is not very good. The cause is the KMA (the local authority), who fails to collect the toilet waste (meaning wastewater) and therefore people dump it into the river. When we started farming, the water was good but now it is becoming bad day after day, but I need money and the market women need vegetables. So, I have to continue, I have no any other choice…"*

Many farmers echo Baba's views. They lack choices for better water or better jobs, so they continue doing what they have always been doing. A ban on the use of wastewater for irrigation was tried out but enforcement was difficult; for farmers it is a "do or die" situation. Villagers, mostly downstream of cities, are crying for their once productive rivers - sources of fish for food and water for bathing and drinking – that are now dead. And consumers have no choice but to buy what is available and in this case vegetables irrigated with highly polluted water. In fact, most of the perishable vegetables are produced in the cities, as refrigerated transport does not exist. One consumer summarised this as *"Ewi enhua, enye tan" (If the eye doesn't see, then it is not bad)*. But this is too simple. In an urban or peri-urban context where whole suburbs have no piped water, where children play on waste dumps around their homes, where toilets are hard to come by, and where raw meat is sold off the bare ground, consumers have other concerns and face more serious challenges than vegetables irrigated with polluted stream water. In 99 percent of all households, consumers are generally aware of the risks and wash or cook whatever they put on the table. This, however, might not always be very effective as studies by IWMI have shown (Amoah, pers. communication). If a child here gets sick, and it is not due to common malaria, then it is most likely caused by playing with waste, poor sanitation or bad drinking water. These are the priority issues that the municipalities are trying to tackle, and waste management already takes 60 percent of their budgets. Perhaps, the child fell ill by eating a piece of raw lettuce, one of the many other possible reasons in an environment so greatly different from the world where "wastewater irrigation guidelines" exist.

IWMI Ghana

Watering is done by hand and is hard labour

The Way Forward

The obvious challenge is the differentiation between actual and potential health risks, and the comparison of actual risks with actual benefits in a given situation. In a survey IWMI carried out in Kumasi in 2001, all health professionals interviewed enumerated a number of negative health impacts, which they attributed to wastewater use. This perception was also supported by standard literature (Shuval et al., 1986, Blumenthal et al., 2000) and led to the imposition of a by-law in Accra that bans drain water use in agriculture. Although hardly enforced, arrests of urban farmers were reported in 2002. This perception of health risks constrains the recognition of irrigated urban agriculture in the country despite its documented contribution to jobs and income and the supply of city markets with perishable crops such as vegetables (Danso et al., 2002). For example, 90 percent of the lettuce and spring onions consumed in Kumasi are produced in the city itself.

As in other low-income countries, irrigated urban and peri-urban farming is a growing enterprise in Ghana, which requires no external facilitation, but would be much more productive when recognised by the authorities., tenure security etc., for example in the frame of poverty reduction programmes. But as much as support is needed to enhance the benefits of irrigated urban agriculture, equal emphasis should be given to health risk reduction measures (Drechsel et al., 2002).

Considering the large number of stakeholders involved, dialogue and platform building will be crucial elements of any balanced approach to move wastewater irrigation forward. Such an approach has to be innovative and should address the following aspects:

Prevention: In many West African cities, municipal planning is under-resourced, not legally binding and is unable to keep track with the urban sprawl. Entire suburbs develop with no provisions for sanitation or other infrastructure such as schools, hospitals, parks etc. In the best case, storm water gutters take over sewerage functions. There are no provisions or plans for wastewater collection or treatment. Urban planning needs much stronger support to address sanitation challenges long before they arise!

Low-cost technologies: But actors involved in managing wastewater at the generation, treatment and disposal phase need to be practical and realistic. Most facilities and regulations have been designed based on experiences and standards from the developed world, where taxes and sanitation fees can easily maintain whole treatment systems. Adopting simple, possibly decentralised systems with low-cost treatment options has not received adequate attention, but appear more suitable though less prestigious.

Agricultural use oriented: Growth in urban populations has not only led to increased use of water, hence more wastewater generation, but also to increased urban food demands. If the crucial link of generation/treatment of wastewater to agricultural use is made, then the perception of wastewater as a nuisance will change to that of a valuable resource.

Alternative risk reduction strategies: Actors should work together to look for non-traditional, user-oriented strategies to reduce health risks, also in situations where perfect treatment plants are not feasible. Low-cost but well-targeted options are possible at the farm level with extra attention on post-harvest contamination at the household level. Such options will have to be linked with awareness and sensitization campaigns.

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Wastewater Treatment and Reuse for Food and Water Security

Naser I Faruqui

In the Middle Eastern and North African (MENA) countries, water is the key development issue. The average rate of the region's annual population growth is one of the highest in the world (around 2 percent) while its natural water supply is scarce. As a result, average renewable fresh water availability in the region has dropped to about 1,428 m3 per year, though many countries in the region fall well short of this[1]. Moreover, the available water is of a lower quality because of increasing pollution and over-pumping.

This situation is compounded by the high urbanisation rate in MENA. It varies from 1.8 percent in Egypt to 4 percent in Palestine[2] and 4.6 percent in Yemen (with an overall rate for the MENA of 2.8 percent,). On average in the region, more than 50 percent of the population lives in cities, with about 91 percent in Lebanon. Within MENA, about 88 percent of all fresh water is used for agriculture. Despite low urban tariffs, the value of water is at least 10 times higher in the urban areas than it is in the agricultural areas (Gibbons, 1986). As a result, water will increasingly be taken out of agriculture and put into urban areas. This means that the region will increasingly suffer from twin and related problems of food and water insecurity.

IDRC

Permaculture Garden using greywater in Tufileh, Jordan

Many countries in the region wish to increase fresh water supplies for domestic and industrial usage, and at the same time expand irrigated agriculture. How can these seemingly contradictory objectives be reconciled? The answer is water-demand management; more efficient water use within all sectors. A specific component of this strategy is to use treated domestic wastewater for industry, for certain municipal purposes such as flushing toilets and irrigating green spaces, but, above all, for urban and periurban agriculture (UPA).

There are a number of benefits in using treated wastewater. First, it preserves high quality and expensive fresh water for drinking. Second, collecting and treating wastewater protects existing sources of valuable fresh water, the environment and public health. In fact, wastewater treatment and reuse (WWTR) not only protects valuable freshwater resources, but also supplements these through aquifer recharge. If the benefits of environmental and public health protection were correctly factored into economic analyses, wastewater collection, treatment and reuse would be among the highest priorities for scarce public and development funds. Third, if managed properly, treated wastewater can sometimes be a superior source for agriculture than fresh water. Not only is it a constant source of water, the nitrogen and phosphorous in the wastewater may result in higher agricultural yields than freshwater irrigation, eliminating the need for additional fertiliser application.

The countries in the region that treat wastewater include Kuwait, Saudi Arabia, Oman, Syria, UAE and Egypt. However, only Israel, Tunisia and Jordan practise wastewater treatment and reuse as an integral component of their water management and environmental protection strategies.

About 80 percent of Israel's treated wastewater is reused in irrigation. In Tunisia, 18 percent of its treated effluent - a total flow of 250m^3/d - is used to irrigate about 4,500 ha of orchards (citrus, grapes, olives, peaches, pears, apples, and pomegranate), fodder crops, cotton, cereals, golf courses and lawns. Almost all of Jordan's treated wastewater is reused - the wastewater collected and treated in the As-Samra wastewater-treatment plant is blended with fresh water from the King Talal reservoir and used for unrestricted irrigation downstream in the Jordan Valley, to produce crops including lettuce, peppers, tomatoes and olives. To a lesser extent in Tunisia, but particularly in Jordan - given that even the furthest sites within the Jordan valley are less than a 45-minute drive from Amman — the agriculture practised can be considered periurban, characterised by its closeness to urban areas, its focus on high-value fruits and vegetables, the relatively small size of plots and the intensity of production. In these countries wastewater reuse is planned at the national level, with effective coordination between relevant ministries, including agriculture, environment, water resources, health, and the water and sanitation utilities. In fact, in both, ordan and Tunisia, these functions are combined in one ministry.

Grey Water Reuse in Urban Agriculture in Jordan

With its low and rapidly decreasing per capita water availability of 148 m^3/p/y, less fresh water will be available for agriculture in Jordan. One means of addressing this threat to food security is to treat and reuse domestic wastewater in UPA. An IDRC-supported project found that 16 percent of the households in Amman already practice UPA, mainly for the production of fruits, vegetables and herbs. The annual value of UA in Amman is US $4 million - already 2.5 percent of the total value of agriculture in Jordan (Government of Jordan, 2002). The problem is that only 40 percent of wastewater in Jordan is collected and treated. The necessary rehabilitation and expansion of the conventional sewerage and wastewater-treatment systems will take time and millions of dollars.

IDRC

Greywater Treatment and Reuse in Tufileh, Jordan

IDRC's research partners have come up with a new approach to combat food insecurity - helping the poor to harvest water at the household level. The systems consist of minor plumbing modifications that divert water from showers, bathrooms and kitchen sinks through small-scale, natural filters in each household allowing residents to recycle water for reuse in home gardens (See photographs). Grey water reuse is much safer than combined wastewater reuse because grey water does not contain pathogens from the toilet. Also, because most "wastewater" is simply "grey water," diverting it from the public sewerage system can dramatically reduce the costs required for installing and expanding such systems. In this pilot project, grey water-treatment systems were installed in 25 homes in Ain Al Baida, Jordan, and members of the households were taught how to set up efficient gardens. Systems were also installed at the main mosque in the community, and at a girl's school. A further 300 systems are currently being installed in another peri-urban area as part of a second phase of this project.

The project has exceeded expectations. The grey water effluent meets standards for restricted irrigation, and households are using it to irrigate eggplant, herbs and olives. The impacts on poverty and water use are still being measured. However, an IDRC study on a previous untreated grey water-reuse project found that the community was able to offset food purchases and generate income by selling surplus production, and by saving or earning an average of 10 percent of its income. Initial water savings were about 15 percent. The economic impact of this project is likely to be much higher because the grey water recovered in this project has already reached 60 percent of the domestic water, nearly twice as much as the previous project in which it was only about 30 percent. Furthermore, previously overflowing septic tanks that cost at least US $60/yr per tank to pump out have not been emptied since the project began. Economic benefits certainly have been significant enough to impress the neighbours of the original beneficiaries - they are now installing the systems at their own cost, proving that households recognise that wastewater treatment can save them or make them money. The Inter-Islamic Network on Water Resources Development and Management (INWRDAM) has improved the original design developed in Palestine with innovations that make the systems safer and more efficient. The medium used in the filters is either gravel or pieces of old irrigation piping. A simple bag filter eliminates clogging associated with previous systems. INWRDAM has also developed an environmentally- friendly dishwashing liquid that prevents soil salinisation arising from grey water reuse, and has begun training workshops on grey water reuse for low-income settlements in Syria and other network countries. The Jordanian Deputy Minister of Social Welfare has visited the Jordan project and is interested in the potential of the systems to alleviate poverty. Also, the Water Authority of Jordan (WAJ), a part of the Ministry of Water, is testing the effluent quality of the systems, at its own cost.

Recommendations

Compared to other countries in the region, Israel, Tunisia and Jordan have successful treatment projects. Based on the experiences of these projects, governments in MENA need to create an enabling environment to encourage safe wastewater treatment. Treatment must form part of an integrated water-management strategy at the basin level, with multi-disciplinary linkages between different sectors such as environment, health, industry, agriculture and municipal affairs. For instance, the main producer of wastewater- municipalities - must interact with the main user - urban agriculture. Urban and rural planning must be integrated so that industries are not situated in locations where their effluent, often high in dangerous constituents such as heavy metals, will contaminate water meant for the biggest user, agriculture. Governments should further facilitate the participation of stakeholders in wastewater-treatment projects, including supporting NGOs working in institution building at the local level. Safe and sustainable decentralised projects will never be established without the willing participation of the beneficiaries. There is also a need to disseminate existing knowledge about the danger of raw wastewater reuse, safe reuse guidelines and the position of Islam on wastewater reuse. There is a perception in MENA that Islam prohibits wastewater use, but in fact as long as the wastewater is treated to extent necessary to protect public health, wastewater use is allowable (Faruqui et al., 2000). Knowledge of cost-effective treatment technologies and crop and soil protection must also be disseminated and site-specific research carried out to fill missing gaps. Most importantly, perhaps, the economic benefits of successful decentralised wastewater-treatment projects must be disseminated to periurban households and farmers, who will only then be willing to contribute to the costs of WWTR. Finally, to ensure the protection of public health and the environment, governments must regulate and monitor the quality of effluents, reuse practices, public health, crop-water quality, and soil and groundwater quality.

Notes

[1] World Development Indicators, 2005, World Bank
[2] The statistics of 4 percent was obtained from UNICEF country data

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Adaptations of Wastewater-irrigated Farming Systems: A Case Study of Hyderabad, India

Stephanie Buechler
Gayathri Devi

Introduction

The Hyderabad/Secunderabad urban and peri-urban area, with its nine municipalities, has a population of approximately 6 million inhabitants. 62 percent of the vast urban area is covered by a sewarage system and treatment is very costly. There are just two sewage treatment plants (STP): one that does primary and secondary treatment and a second that is only capable of primary treatment. In total, these two plants treat 133 million litres per day (MLDs) of water. This treated sewage water together with the untreated sewage water estimated at 327 MLDs (personal communication, HMWSSB, 2002), is diverted to the Musi river. The Musi is now a perennial river due to this year-round inflow of urban wastewater. It has been estimated that a gross area of 16,000 ha is irrigated by the wastewater that flows from the city (Landsat Image, November 2003). Few in-depth studies have been conducted on the smallholders and landless who use this wastewater.

IWMI-India

Harvested Para Grass

Urban and Peri-urban Agriculture of Hyderabad

Along the Musi river thousands of men and women depend on its wastewater for a variety of different activities. Livelihood activities based on the availability of water depend on three factors: 1) the land area available (in urban areas the average land holding is 0.2 ha and in peri-urban areas it is 0.5 – 1 ha; 2) the quality of the wastewater; and 3) the proximity to urban markets. Caste/class, gender and religious affiliations of the users also influence the type of wastewater-related activity. The chain of beneficiaries of wastewater irrigation are: land renters, livestock keepers (who often rent land for fodder production), casual, migrant and permanent labourers, fishermen, vendors and auto rickshaw and truck drivers who transport the agricultural produce from the fields to the local markets.

A variety of crops are grown in Hyderabad and its periphery. The predominant crop is para grass, which is used for fodder, amounting to approx 95 percent of the cultivated area. A farmer can earn an average annual income of US$ 330 (Buechler et al, 2003) from para grass cultivation.Green leafy vegetables are grown on 3 percent of the total cultivated area for subsistence and for sale. More and more people are moving out of vegetable production due to the poor water quality and the high labour requirement. Other crops that make up only 1 percent include trees such as coconut and banana. Coconut leaves (fronds) and banana leaves are sold for Hindu religious ceremonies and are the trees are grown exclusively for this purpose. Certain flowering plants such as crosandra, jasmine, hibiscus and chrysanthemums are also grown. Though the scale of flower production is almost negligible at present, bit could be an emerging new trend in UA.

Advantages of Wastewater Irrigation

IWMI-India

Urban vegetable plots along the River Musi

Wastewater is an extremely valuable resource for agriculture in the water scarce drought prone tropical developing countries. Groundwater levels have also been decreasing in the area due to overdraft and reduced rainfall. Under such water scarce conditions, the importance and potential of wastewater/sewage water for irrigation as a valuable resource has been recognised by the farmers in the urban and peri-urban areas of Hyderabad city. Hyderabad discharges more than 530 million liters of wastewater per day, which is used for irrigation in urban, peri-urban and rural areas. The 16,000 ha irrigated with wastewater creates livelihoods for about 48,000 people who are directly or indirectly dependent on wastewater for their food security (Buechler et al., 2002). This water is available throughout the year and on-demand irrespective of the rainfall. Casual labourers working in the para grass fields in peri-urban areas have employment all year-round. Male labourers are paid $ 2.22 per day (8 hrs of work) and the women are paid $ 1.77 per day. Wastewater is rich in nutrients (esp., nitrogen) and its use in irrigation helps recycle these nutrients. Farmers in the urban and peri-urban areas do not use any fertilisers for their crops and save 15-20 percent of their farming costs. Another important advantage of wastewater is that it prevents the use of groundwater for agriculture and to some extent recharges it. The groundwater level in the wastewater-irrigated areas has been found to be very high. Wastewater use in urban agriculture helps in maintaining the greenery in the city and also helps improve the air quality.

Risks Associated with Wastewater Irrigation

Under canal wastewater irrigation, people have been growing paddy for many decades in the peri-urban areas of Hyderabad. However, with the deteriorating water quality, the paddy yields have gone down. Moreover, the percentage of broken grains has increased (after milling the paddy). The farmers say that although the crop appears very healthy and grows really fast (in about half to two thirds of the time) compared to paddy grown further away from the river with groundwater, the final yield (the amount of grain from the paddy) has drastically decreased. This was corroborated by a pilot study consisting of soil and paddy plant sampling in the peri-urban area and analyses conducted by IWMI (Simmons et al, unpublished, 2002). Soil contamination due to wastewater irrigation is a common problem in all untreated wastewater-irrigated areas. Preliminary observations indicated significant accumulation of copper, zinc, and phosphorous in soils used for agriculture within the urban study area. The risk to the consumers is expected to be low since none of the vegetables grown are consumed raw. However, no quality-assurance tests were done on the vegetables (Buechler et, al, 2002). Groundwater pollution is also a serious problem in the wastewater-irrigated areas in Hyderabad. Farmers and residents in the periurban area report that the groundwater in a radius of one kilometer of wastewater-irrigated areas is saline and not potable. Wastewater farmers and labourers mention frequent fevers, diarrhoea, and sores on parts of their hands and legs exposed to wastewater.

Strategies Adopted by Farmers to Mitigate Risks of Wastewater irrigation

In periurban areas, with the change in river's water quality due to the release of wastewater and increased soil salinity, production of traditional crops like paddy has become unprofitable. Therefore farmers have shifted to other crops, which grow better on wastewater and tolerate high soil salinity. Thirty years ago, Mr Laxminarayana, an innovative farmer introduced para grass on a small plot of land and within 2.5 months got a lush green crop. He fed it to his cattle; the animals readily devoured the fodder. This encouraged him to make small bundles of the grass and sell it to other cattle owners. With para grass, he could get the equivalent of the income from one crop of paddy (5 months) in just 2.5 months. This encouraged him to grow para grass on a larger area. Today, hundreds of farmers along the Musi use wastewater for para grass production and are making profits. Once planted, para grass can be harvested continuously for more than 20 years without replanting. It grows extremely well on wastewater in spite of the industrial pollutants and arrests the bad smell of the wastewater. The crop requires very low investment. Once planted, no fertiliser is required and only a small quantity of pesticide is applied in the winter. Other than the labour costs for harvesting, the crop does not involve hardly any other costs.

In urban areas where untreated wastewater is diverted directly from drains into the fields for irrigation, farmers are shifting from vegetables to tree crops (eg. coconut) where the human contact with wastewater is much less. Farmers are also now growing flower crops such as jasmine, crosandra, chrysanthemums and hibiscus, which are non-edible and therefore decrease health risks related to wastewater.

Another new strategy that is being adopted by periurban paddy farmers is that of mixing wastewater with groundwater. This practice helps farmers to reduce salinity of groundwater. Some farmers alternate wastewater use with groundwater use depending on the need of the crop. Since wastewater promotes vegetative growth due to its high nitrogen content, farmers prefer to irrigate paddy with wastewater during its initial stage of growth. Once flowering sets in, groundwater is used to irrigate the crop until harvest.

Conclusion and Recommendations

Authorities worldwide, and in developing countries in particular, need to recognise wastewater as a valuable resource and ensure the sustainability of the livelihoods of the people dependent on it. Location and actor-specific solutions need to be developed to ensure social acceptability, economic viability and technical feasibility. Some of the recommendations are:

- Commission and support need-based research derived from participatory research methods
- Develop extension services tailored to each socio-economic category of wastewater users including farmer-to-farmer exchanges
- Encourage farmers to grow non-edible crops with wastewater such as flowers (eg. jasmine)
- Prevent the mixing of industrial effluents with sewage
- Promote low-cost water treatment technologies (i.e stabilisation ponds)
- Invest in research and development for cheaper sewage treatment methods
- Encourage farmers to take precautions when using wastewater (minimise body contact with wastewater during irrigation and other agricultural operations and wash hands and legs with soap after contact with wastewater)
- Prevent further contamination in the markets where the wastewater-irrigated produce is sold by improving hygienic standards

- Spread awareness among consumers and other users through posters and documentaries
- Advise municipalities and other relevant authorities to use wastewater for watering public parks and avenue trees and encourage them to plant local varieties that need less water
- Encourage statutory bodies (eg. Pollution Control Board) to hold open public forums on water quality data to make the process transparent and participatory

With a growing water scarcity around the world, the use of wastewater for irrigation will become even more prevalent in developing countries. It is therefore of utmost importance to safeguard the livelihoods, health and environments of wastewater-dependent women, men and children.

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The Hyderabad Declaration

The International Water Management Institute (IWMI) in collaboration with the International Development Research Centre (IDRC) convened a meeting of minds through an international workshop entitled *Wastewater Use in Irrigated Agriculture: Confronting the Livelihood and Environmental Realities,* which was held in Hyderabad, India, from 11-14 November 2002. The workshop's objective was to critically review experiences with the widespread use of untreated wastewater in agriculture focusing on the livelihoods of the poor, and health and environmental risks. Participants were diverse with a presence of 47 groups of researchers and practitioners from 27 national and international institutions including the World Health Organisation (WHO).

IWMI's past and ongoing studies in Pakistan, India, Ghana, Vietnam, and Mexico have clearly demonstrated the livelihood implications of wastewater irrigation while highlighting the human health and environmental impacts. Management options identified with partners and stakeholders include improved health safeguards, cropping restrictions, blending wastewater with freshwater, appropriate irrigation techniques, primary stabilisation or other low-cost alternatives, and pollutant-source management. However, institutions and individuals who are global leaders in wastewater-treatment, agriculture, sanitation and urban planning have largely ignored the practice and its implications. This workshop was a first step in reaching out to wastewater, agriculture, planning and health professionals and confronting them with the realities of wastewater irrigation.

A number of case studies covering different regions of the world, and comprising applications of wastewater ranging from the treated to the untreated, were extensively discussed and debated. Three workgroups addressed issues of assessing the global use of wastewater, the health and environmental implications and related guidelines, and institutions and future research directions. Two major breakthroughs were:

(1) a common vision and agenda for the future contained in the Hyderabad Declaration which follows below; and

(2) the discussion with the World Health Organisation (WHO) to take into account the realities in reviewing the guidelines for wastewater use in agriculture.

The Hyderabad Declaration on Wastewater Use in Agriculture

1. Rapid urbanisation places immense pressure on the world's fragile and dwindling fresh water resources and over-burdened sanitation systems, leadingto environmental degradation. We as water, health, environment, agriculture, and aquaculture researchers and practitioners from 27 i nternational and national institutions, representing experiences in wastewater management from 18 countries, recognise that:

   1.1 Wastewater (raw, diluted or treated) is a resource of increasing global importance, particularly in urban and periurban agriculture.
   1.2 With proper management, wastewater use contributes significantly to sustaining livelihoods, food security and the quality of the environment
   1.3 Without proper management, wastewater use possesses serious risks to human health and the environment.

2. We declare that in order to enhance the positive outcomes while minimising the risks of wastewater use, there exist feasible and sound measures that need to be applied. These measures include:
   2.1 Cost-effective and appropriate treatments suited to the end use of wastewater, supplemented by guidelines for application.
   2.2 Certain activities to take place where wastewater is insufficiently treated, and until treatment becomes feasible:

      (a) development and application of guidelines for untreated wastewater use that safeguard livelihoods, public health and the environment;
      (b) application of appropriate irrigation, agricultural, post-harvest, and public health practices that limit risks to farming communities, vendors, and consumers; and
      (c) education and awareness programmes for all stakeholders, including the public at large, to disseminate these measures.

   2.3 Health, agriculture and environmental quality guidelines that are linked and implemented in a step-wise approach.
   2.4 Reduction of toxic contaminants in wastewater, at source and by improved management.

3. We also declare that:
   3.1 Knowledge needs should be addressed through research to support the measures outlined above.
   3.2 Institutional coordination and integration together with increased financial allocations are required.

4. Therefore, we strongly urge policy-makers and authorities in the fields of water, agriculture, aquaculture, health, environment and urban planning, as well as donors and the private sector to:

Safeguard and strengthen livelihoods and food security, mitigate health and environmental risks and conserve water resources by confronting the realities of wastewater use in agriculture, through the adoption of appropriate policies and the commitment of financial resources for policy implementation

Signed 14 November 2002, Hyderabad, India

Resources

Wastewater use in irrigated agriculture: confronting the livelihood and environmental realities
Scott CA, Faruqui NI & Raschid-Sally L (eds). 2004. IWMI / IDRC-CRDI / CABI Publications. Wallingford, UK, pp 135–144.
This volume presents a wide spectrum of experiences and perspectives on wastewater use in agriculture. It is an outcome of the joint IWMI-IDRC workshop held from 11–14 November 2002 in Hyderabad, India. The volume has the potential to change the thinking of decision makers in international bodies such as the World Health Organization, national and state governments, as well as researchers and practitioners. The book contains a series of thematic chapters aimed at giving a better understanding of wastewater use in agriculture in developing countries with detailed case study documentation of what works and what does not. The *Hyderabad Declaration on Wastewater Use in Agriculture,* an important outcome of the November 2002 workshop is presented as Appendix 1 of this volume.

Making a Living Along the Musi River near Hyderabad, India.
Buechler, S., Devi, G. and Rama Devi (directors). 2003. Documentary video co-produced by the International Water Management Institute (IWMI), Department of International Development (DFID), UK and the Resource Center on Urban Agriculture and Food security (RUAF)-ETC-Netherlands Foundation, The Netherlands.
This documentary presents a case study of wastewater use for urban and peri-urban agriculture in Hyderabad, highlights the its positive and negative aspects through a series of interviews with users and suggests recommendations for better management of this valuable resource.

Reuse of wastewater in urban agriculture, a challenge for municipalities in West Africa. Proceedings of Ouagadougou Workshop
W. Hertog. 2002 (ed).
This five-day event took place from 3-7 June 2002, and was organised by ETC-RUAF together with CREPA headquarters in Ouagadougou, Burkina Faso, and was financed by CTA Netherlands. The proceedings cover the paper presentations, working group discussions and site visits. The report can be found at www.ruaf.org (in French).

Water and Wastewater: Developing Country Perspectives
Rema Devi and Naved Ahsan (Eds.).. 2002. ISBN 1-84339-500-2: International Water Association. This volume included as IWA's Water and Environment Management Series with ISSN 1476-1785. 1223 pages
This edited volume has selected papers presented at the international conference "Water and Wastewater: Perspectives of Developing Countries" (WAPDEC) held in New Delhi, India, from 11-13 December, 2002. The papers present the many facets of water and wastewater use and thereby emphasise the need for communication within the water community.

Water Management in Islam.
Faruqui, Naser I, Asit K Biswas and Murad J Bino. 2001. United Nations University Press and International Development Research Centre, Ottawa, Canada.
This volume presents an Islamic perspective on a number of proposed water-management policies, including water-demand management, wastewater reuse, and higher tariffs. The book opens avenues for a wider dialogue amongst researchers working at identifying the most promising water-management policies, adds to our knowledge of some of the influences on formal policy and informal practice, and makes these ideals available to a broader public. *Water Management in Islam* will interest researchers, scholars, and students in natural resource management, Islamic studies, Middle Eastern studies, development studies, and public policy.

A Framework for Analysing Socioeconomic, Health and Environmental Impacts of Wastewater Use in Agriculture in Developing Countries.
Hussain, I, L Raschid, MA Hanjra, F Marikar and W van der Hoek. 2002. IWMI Working Paper 26. International Water Management Institute, Colombo, Sri Lanka. http://www.cgiar.org/iwmi/pubs/working/WOR26.pdf
The biggest challenge faced by policymakers at present, is how best to minimise the negative effects of wastewater use, while at the same time obtain the maximum benefits from this resource. While most of the impacts of wastewater use, both negative as well as positive, are generally known, a comprehensive evaluation of the benefits and costs of these impacts has not as yet been attempted. Conventional cost-benefit analysis is not adequate to evaluate the impacts of wastewater due to its environmental and "public good" effects. To fill this gap in knowledge, this paper attempts to develop a comprehensive assessment framework applying available and tested techniques in environmental economic analysis for the comprehensive evaluation of the costs and benefits of wastewater.

Guidelines for Wastewater Reuse in Agriculture and Aquaculture: Recommended Revisions Based on New Research Evidence
Blumenthal, Ursula J, Anne Peasey, Guillermo Ruiz-Palacio and Duncan D Mara. 2000. Report summary of WELL Task No. 68 (Part 1). London School of Hygiene & Tropical Medicine, Loughborough University, UK (67 pp).

http://www.lboro.ac.uk/well/resources/well-studies/summaries-htm/task0068i.htm
WELL is the DFID-funded resource centre promoting environmental health and well-being in developing and transitional countries. WELL is designed to coordinate and provide services for water, sanitation and environmental health programmes to DFID and other agencies. This study reviews the WHO (1989) Guidelines for Wastewater Reuse in Agriculture and Aquaculture in the light of recent epidemiological studies of the London School of Hygiene and Tropical Medicine with colleagues in Mexico and Indonesia, and microbiological studies of crops irrigated with treated wastewater by Leeds University, with colleagues in Brazil and Portugal.

Épuration des Eaux Usées et l'Agriculture Urbaine (Wastewater Treatment and Urban Agriculture)
M Gaye and S Niang. 2002. ENDA Tiers Monde, Dakar, Sénégal (354 pp). (In French)
This book gives detailed insights into wastewater research and treatment in Senegal. It has three parts: 1) sanitation policies in Senegal and participation of the inhabitants in demand management; 2) making use of wastewater for urban agriculture in Dakar; 3) treatment efficiency of wastewater through stabilisation ponds. Thanks to the detailed description of methodologies, the book can be very useful for anybody wanting to undertake similar wastewater-treatment *cum* -reuse research in another sub-Saharan country.

Wastewater Use in Agriculture: Review of Impacts and Methodological Issues in Valuing Impacts.
Hussain, Intizar, Liqa Raschid, Munir A Hanjra, Fuard Marikar and Wim van der Hoek. 2002. Working Paper no. 37. International Water Management Institute. Colombo, Sri Lanka.
http://www.cgiar.org/iwmi/pubs/working/WOR37.pdf

Urban Wastewater: A Valuable Resource for Agriculture: A Case Study from Haroonabad, Pakistan.
Van der Hoek, Wim, Mehmood UlHassan, Jeroen Ensink, Sabiena Feenstra, Liqa Raschid-Sally, Sarfraz Munir, Rizwan Aslam, Nazim Ali, Raheela Hussain and Yutaka Matsuno. Research Report 63. International Water Management Institute.

Wastewater Reuse in Agriculture in Vietnam: Water Management, Environment and Human Health
Aspects - Proceedings of a Workshop held in Hanoi, Vietnam, 14 March 2001,
Raschid-Sally, Liqa, Wim van der Hoek and Mala Ranawaka (eds). 2001. IWMI Working Paper 30. International Water Management Institute, Colombo, Sri Lanka (48 pp).

www.irc.nl
The site of IRC, the International Water and Sanitation Centre, contains a wealth of news and information on the subject together with projects and experiences of IRC and its networks with low-cost water supply and sanitation in developing countries.

www.who.org
A compilation of WHO information on water, sanitation and health is available at WHO's water sanitation and health electronic library. It includes many of the current publications and documents.

www.cgiar.org/iwmi
A major source of information on the topic of water is the International Water Management Institute, whose mandate is "improving water and land resources management for food, livelihoods and nature. Their site provides a number of updates, policy papers, publications as well as free subscription to their electronic bulletins.

www.iwapublishing.com/
The International Water Association (IWA-) provides information services on all aspects of water, wastewater and related environmental fields. It includes *Water21*, the IWA membership magazine, and a broad range of journals, books, scientific & technical reports, manuals, newsletters and electronic services.

www.sandec.ch
SANDEC is the Department of Water and Sanitation in Developing Countries at the Swiss Federal Institute for Environmental Science and Technology. SANDEC's research activities focus primarily on the use of waste and wastewater, with urban agriculture as a recent topic.

www.cepis.ops-oms.org
The website of the Centro Panamericano de Ingeniería Sanitaria y Ciencias del Ambiente (the Pan American Centre for Sanitary Engineering and Environmental Sciences) is in Spanish and English and focuses on Latin America. It contains information on publications, events, training materials, etc.

www.weather.nmsu.edu/hydrology/wastewater/
The Middle East Wastewater Use Clearinghouse is a site established to promote knowledge about the use of wastewater on agricultural land to increase the limited water resources available in the Middle East.

Chapter 10

Participatory Technology Development for Sustainable Intensification of Urban Agriculture

The urban setting offers special advantages for food and animal production, but also presents particular challenges. Urban agriculture needs to be highly innovative in competing and adapting to new situations. Urban and peri-urban agricultural systems exhibit even higher levels of complexity than rural upland systems and call for a wider range of participatory methods. This chapter discusses participatory agricultural research and its relevancy for the urban setting. A sustainable urban livelihoods framework is discussed, which enables to better understand and define the multi-sectoral, institutional and policy aspects of urban agriculture in order to identify appropriate interventions. Specific participatory methods are discussed for urban horticulture and livestock to help urban producers adapt agriculture to urban realities.

Participatory Technology Development for Sustainable Intensification of Urban Agriculture

Gordon Prain

Introduction

The production of food, feed, fuel and construction material in and around cities has almost as long a history as human settlements themselves. The earliest cities in the Fertile Crescent, in China and in South and Central America report the presence of local food production, which was an essential component of urban food security in times of conflict and military insecurity (Southall, 2001). The urban setting offers special advantages for food and animal production, but also presents particular challenges. Cities accumulate nutrients through the concentration of human population and their organic waste products, whether in solid or liquid form. These nutrients can often be acquired free or at low cost and can be converted into edible plant parts or animal products. On the other hand, as cities develop, there is increasing demand for residential and business accommodation which competes with agricultural space. Producers must adapt to these more constrained conditions, whilst still trying to maintain productivity through intensifying production techniques.

Producers' adaptation of agriculture to urban realities also occurs within a policy environment which is much more challenging than the rural context. This is partly because of the density of the population and intense competition for natural, physical and financial resources in urban settings which municipal governments try to arbitrate. It is also because of the density of competing economic and political interests present in the city, in which the local council is only one player.

IWMI Ghana

The treadle pump used around Accra for irrigation of vegetables

Another feature of cities is their dynamic nature: a constant flux of growth, decay and transformation which puts a very high value on continuous technological innovation to maintain or enhance productivity and sustainability. As part of their livelihood strategies, urban producers are already engaged in innovative adaptation to new circumstances. This chapter argues that to support them, we need to employ participatory methods, for the same reasons as they have been essential for working with complex rural agriculture systems – mixed upland systems for example - the need to combine local knowledge and innovation skills with new technical opportunities.

This is the context for participatory technology development in urban agriculture systems which will be explored in the following sections.

Agricultural Technology Development

Why has agricultural research been so little concerned with urban agriculture (CGIAR 1998). The answer is related to the sectoral separation of "urban" and "rural", a separation that has its roots in the Industrial Revolution and its subsequent transfer through colonial expansion to the developing world.

RUAF

Watering roof top vegetables

In northern Europe, the industrial revolution came to be seen as an urban revolution, associated with cities such as Manchester, Liverpool and Birmingham in the north and midlands of England. The workers who were employed in the new factories came from agricultural communities. Cities became part of what was seen as a movement away from an agrarian society towards industrialisation and the creation of wealth through capital investment. Rapid urban growth occurred around manufacturing and service industries and included dense, low-cost residential housing for the new industrial workforce – the future inner city slums – together with elite suburban settlements, occupied by the "captains of industry" and the professional classes who supported them (Fishman, 1987). Yet this division was more ideological than real. Because transport systems failed to keep pace with urban growth, food supply to cities remained a problem. In England and other European countries, municipal authorities were obliged to "allot" small plots to workers' families for food production (Burchardt, 1997). These allotment gardens have been reduced in size or have changed location, but they never left the cities in Europe.

The colonial expansion of northern European economies, driven by the search for new sources of raw materials as well as for new consumer markets, exported the sectoral divide between "rural" and "urban" to the developing world, with efforts made to keep "rural" agricultural local populations out of the colonial urban centres, except for the provision of services to the colonists (Tibaijuka, 2004).

This divide has come also to characterise the investment by public sector agencies in technology generation. Agricultural technology development has been almost exclusively oriented towards rural needs, whereas research on manufacturing processes, product transformation, infrastructure and sanitation has been focused mainly on urban needs.

Early investments in research and development for rural agriculture were primarily associated with fertiliser development (an off-shoot of military research into munitions and one of the few examples where weapons really have been turned into ploughshares), pesticide development and more recently, especially in the second part of the 20th century, plant genetics and breeding (Simmonds, 1979). Plant breeding began to be applied to the developing world's main food security crops of rice, wheat and maize during the 1960s, seeking to increase the fertiliser responsiveness and harvest index of the crops (ratio of grains to other parts of the plant biomass) and therefore their food productivity.

The methodological background to this technology development process, which became known as the Green Revolution, was the notion of a central source of innovation (Biggs, 1990; Biggs and Farrington, 1991). This notion proposes that agricultural innovations are generated in centres of excellence by scientists, are then pushed out to national agricultural programmes which may conduct some local adaptive research before transferring the technology to extension services and thence to early-adopting farmers, who then abandon traditional practices. Although this "pipeline" or top-down approach succeeded in greatly increasing the production of rice, wheat and maize in the relatively simple farming systems in breadbasket regions of the developing world – the Indo-Gangetic plain, the irrigated lowland valleys and plains of Southeast Asia, the maize-producing valleys of central Mexico – it made little impact on ecologically, agronomically and socio-economically more complex upland farming systems. These systems have to adapt to difficult, risk-prone environments and this demands local farmer innovation in crop-livestock management in multiple micro-environments. A quite different, participatory approach to agricultural research is required to enhance the capacity of these systems to ensure year-long food and income security for households.

In these more complex situations it is necessary that researchers and agricultural producers first conduct situation analysis (Martin et al 2001) to analyse the existing strengths and weaknesses of local farming systems, regional agro-enterprise and marketing systems (Bernet et al., 2005) and the body of available indigenous and incorporated knowledge. Farmer-led experimentation can then evaluate alternative options for change, drawn from both local experience and national and international scientific resources. This is the essence of participatory technology development (PTD), an on-going process of innovation that blends new and tested principles and practices to changing local realities (Chambers et al., 1990; Haverkort et al., 1991; Douthwaite, 2002).


Petra Jacobi UVPP

Participatory planning undertaken in Dar es Salaam

This brief review of the background to participatory agricultural research is relevant because urban and peri-urban agricultural systems exhibit even higher levels of complexity than rural upland systems and call for a wider range of participatory methods (Veenhuizen et al., 2001). As well as the need for situation analysis of the diverse mixed farming systems in a range of (urban) micro-ecologies, there are specific interactions with the urban environment that must be analysed. These concern the opportunities and risks of accessing and recycling accumulated urban nutrients (Dubbeling et al., 2005); the need to adapt and intensify production in space-constrained conditions (Veenhuizen, 2003); the risks of exposure to urban contaminants (Cole et al., 2004); the opportunities of agro-enterprises and accessing diverse nearby markets (Holmer, 2001; Peters et al., 2002); and the need to engage with a dense and often intrusive regulatory, policy and planning environment, which impinges on agriculture in multiple ways and makes demands on the types of technologies that can be used (Dubbeling, 2001).

Finally, agricultural production in urban areas is rarely the only or even the major livelihood activity of households. It is combined and sometimes integrated with part- or fulltime activities in other urban sectors, such as the construction, manufacturing and service industries[1]. This creates intricate decision-making processes within households regarding the deployment of household resources in livelihood strategies. Gender and inter-generational relations and sustainability considerations are part of these processes and a more comprehensive framework is required for their analysis and for the design of interventions (Rakodi and Lloyd-Jones 2002).

In the next section the sustainable urban livelihoods framework will be introduced, to better characterise the multi-sectoral, institutional and policy aspects of urban agriculture and identify appropriate interventions. After that, several specific participatory methods to help urban producers adapt agriculture to urban realities will be reviewed.

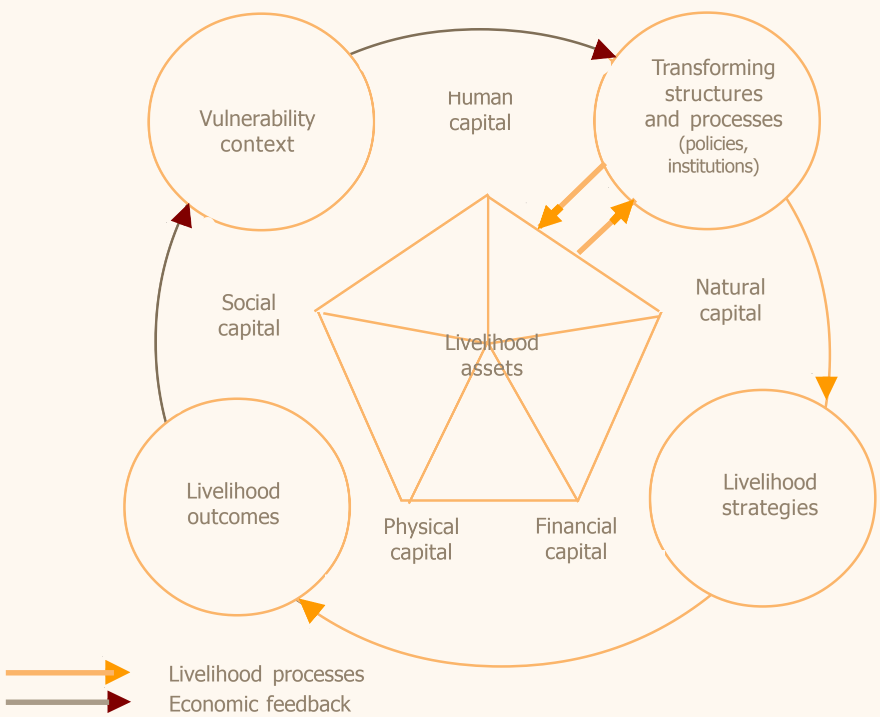
Farming Systems and Livelihood Systems in the Urban Environment

The concept of "farming system" was developed during the 1970s to capture the multiple, integrated components and large-scale continuities in rural agriculture and to identify points of technology intervention for particular types of systems (Norman et al., 1995). It also has value to understand the situation of urban agriculture, which exhibits a similarly high degree of biological and agronomic diversity at one level but also the potential for identifying continuities, common features and broadly applicable interventions. Farming systems research seeks to understand the integration of agricultural production involving crops, animals and the use of natural resources, the deployment of household and hired labour and linkages with markets. Its weakness has been its agro-centrism - seeing everything through the agricultural lens and often the lens of the individual farmer – and also a difficulty to characterise adequately the feedback loops linking the farm and farm household with other local and regional systems, whether ecological systems such as watersheds or socio-political systems such as local political structures, food systems and different kinds of markets.

The more recent emergence of livelihood systems approaches has enriched action research and development work with agrarian societies, by adopting a broader perspective that analyses households dynamically, in terms of the deployment of their accumulated assets through livelihood strategies that are constrained both by external stresses and shocks and by the need to engage with local and national institutions, policies and processes (Farrington et al., 1999). Although developed to better analyse rural realities, this approach has proved to be very fruitful for understanding households in urban settings, including those engaged in different kinds of agricultural production (Radoki and Lloyd-Jones, 2002).

Increasingly in rural settings, and very much so in complex urban contexts, poor households depend on multiple income sources, credit, physical resources such as equipment and technology, access to natural resources, and a range of non-material assets such as local knowledge, formal education, health and social support structures to ensure their livelihood. Inadequate assets can leave households vulnerable to economic, environmental, health, and political stresses and shocks, which is referred to as the vulnerability context (Figure 10.1).

Figure 10.1 *Sustainable Urban Livelihood Framework*



Adapted from DfID 2001. Sustainable Livelihoods Guidance Sheet. DfID, London

Household-based Assets have been Classified into Five Types or Capitals[2]

Natural capital involves the quantity and quality of accessible land, water and biodiversity. The basic ingredients for both crop and livestock agriculture are water and nutrients. Nutrients for crops are delivered mostly through soils, though their delivery in water in hydroponics systems is also important in urban settings (see below). Conditions and management of soils differ widely in urban settings and across different types of urban and peri-urban agriculture, though frequent, common problems include the presence of inorganic materials – especially heavy metals and trash – and a high level of compaction (Evans et al., 2000). Because small urban plots are often intensively used, soil fertility is a constant challenge as will be discussed further below, and the incorporation of urban nutrients via vegetative or co-composting is a key area for PTD in urban agriculture. Nutrients for livestock production involve access to forage and other feed sources and their efficient use in livestock nutrition. These feed sources are often scarce in urban and peri-urban areas and this leads frequently to complex nutrient exchanges along rural to urban transects, for the benefit of both animal and crop production (Njenga et al., forthcoming).

Alain Santandreu

Drawing own plots in participatory diagnosis in Montevideo

Water is also often a scarce natural resource in urban areas, and there is frequently intense competition between agriculture and domestic and industrial uses. "Resource recognition" is important in this context (Furedy 1992; Smit and Nasr, 2001). "Hidden" natural resources can be accessed, such as unused water surfaces and nutrient-rich wastewater (see Chapter 9, this volume). The notion of resource recognition is also important for accessing land, through use of vacant lots, unused public lands, and the composting potential of urban solid wastes (see Chapter 8, this volume).

Biodiversity is a key natural resource that supports agriculture. Population pressure, presence of contaminants and the fragmentation of green spaces in urban areas can severely reduce the resilience of plant and animal populations and their capacity for survival and for symbiotic interactions in ecological systems. PTD involves not only the identification of native species and varieties of plants and animals that are well adapted to urban soils and other conditions, but also the application of practices that enhance species resilience and symbiosis, for example, through biological pest control.

It is not always easy to differentiate natural and physical capital in the urban environment. Water, for example, is usually considered part of natural capital. Yet when it is cleaned and piped to the homes of urbanites, it becomes "adequate water supply and sanitation, which is part of physical capital according to DfID's literature on livelihoods. Organic wastes can also be considered part of the natural capital of the urban environment which is available for composting, yet when chemical fertilizer is packaged and purchased by households; it is usually considered part of physical capital. The important point here is not about trying to create watertight boundaries, but about the access of poor households to these different types of capital.

Physical capital includes the buildings, equipment, tools and physical inputs to agriculture and other activities, such as seeds, fertilisers, pesticides, animals, a small kiosk for trading, a sowing machine etc. PTD can have a direct impact on physical capital through improving the quality and fit of assets such as seed and equipment with the urban environment.

Financial capital refers primarily to the income available to the household from different sources, but also to loans and credit. (see Chapters 4 and 7) As already mentioned, households in urban and peri-urban areas are rarely dependent on a single income source. Different household members access different sources of income, and the same individual may also manage different occupations simultaneously. A common example would be a woman who is responsible for household food preparation and child-rearing, contributes to raising crops and animals and engages in petty trading (Arce et al., 2004).

Human capital includes labour, knowledge and the health status of family members and the ways these are deployed – or impaired – in livelihoods strategies. The local technical knowledge which household members utilise in agricultural activities is an important example of human capital. The depth of this knowledge, which is so critical in the management of complex rural farming systems, may be less obvious among migrants from totally different agricultural environments, or among non-agricultural households seeking ways to better secure family food security. Evidence from research with horticulturalists in Hanoi, Vietnam, indicates a reduction of use of toxic pesticides with greater time spent farming in a given environment, suggesting a growth in local knowledge of how to manage horticultural pests (de Bon et al., 2004).

Robert Holmer

Applied drip irrigation in allotment gardens in Cagayan de Oro

Human health is another key aspect of human capital that needs special attention in urban areas. Conditions in low-income areas of developing world cities often create health risks for the urban poor (Hardoy et al., 1990). Participation in agriculture can intensify negative health impacts on human health, through human and food exposure to contaminants and other illness-producing hazards in water, soils and animals (Birley and Lock, 1999). Health impacts can also be positive through nutritional and other health benefits of farming and farming products (Armar-Klemesu, 2000).

Social capital includes the access to and membership in social networks, groups and associations of different kinds, through which households gain access to other assets, such as knowledge, financial loans, labour and different kinds of support and security. Social capital also involves the trust that exists with others, which facilitates access to resources and enhances the sense of well-being and psycho-social health. Social capital is strongly gendered, in that social networks, trust, sharing and social support tend to be forged within the sexes rather than between, though important exceptions to this generalisation exist, including religious organisations. Relatively little work has been done so far on social capital in relation to urban agriculture, but there are examples of its contribution to community building, especially in the USA and Europe, and to improvements for HIV/AIDS affected communities (see Chapter 6, this volume). Research findings in both Latin America and Africa suggest that women play a major part in harnessing and maintaining social capital in support of crop and animal production (Maldonado, 2005; Maxwell, 1992; Chapter 5 this volume). The deployment of assets in household strategies, the influences and impediments which household members experience when they deal with urban institutions such as municipal regulations and policies or local marketing practices, and the livelihood outcomes which they achieve, are all part of urban livelihood processes. These processes in turn exert positive and/or negative ecosystem feedback on the livelihood assets and on the vulnerability context (see Figure 10.1). This means that efforts to develop physical and human capital through PTD need to take into consideration the effects of the technology on other household assets. For example, a technology involving high financial investment, such as drip irrigation, would reduce household financial assets that may be needed for other investments such as education or health care. PTD also needs to monitor the implications of alternative technologies for urban institutions and processes. For example, technologies for improving feed efficiency and thus profitability of pig-raising in locations where the municipal authority prohibits keeping animals (see the Hanoi case, Peters et al., 2002).

Whereas PTD in rural contexts has typically involved farmers and technicians jointly evaluating technology options in terms of their fit with the local farming and food system, the addition of an urban livelihoods systems framework locates the assessment of technologies in a more cross-sectoral, policy-sensitive setting. The rest of this chapter will explore a range of experiences evaluating technologies for urban use and highlight the way they have tried to adapt to different dimensions of livelihoods in the city

Participatory Technology Development: intensification and livelihoods

The wide range of farming systems found in urban areas can be differentiated in terms of types of intensification and their potential for positive and negative impacts on livelihoods. The urban setting encourages intensification and evidence suggests that the productivity of these systems is systematically higher than in rural areas (Yeung, 1987). Technology development needs to be focused on ensuring that intensification of both crop and animal production and processing offers maximum benefits to urban livelihoods and minimum negative impacts on the health of producer and consumer families, their neighbours and on the urban environment.

Agricultural intensification has usually been associated with the increase of output per unit of land area, through technical changes in crop management, especially the use of modern varieties and animal races, increased use of fertilisers and pesticides for crops, prepared feed, antibiotics and vaccines in livestock production, and improved water efficiency, especially via irrigation (Matson et al., 1997). Intensification in urban and peri-urban settings can be described as maximising output from minimal space. This also involves input technologies such as crop varieties and their combinations, seed management, animal nutrition, soil nutrition and water management. Pest and disease management is of major importance in some urban systems and almost ignored in others. Two aspects of intensification in the urban context which are less common or non-existent in rural agriculture (which will be considered later) involve the manipulation of vertical space[3] and the recycling of domestic and commercial organic wastes as sources of soil or animal nutrition. This concerns technologies of composting or co-composting and the large-scale collection and preparation of restaurant and other food residues for animal feed, sometimes in combination with available forage. Although use of small quantities of domestic food residues is very commonly fed to animals also in rural areas, this urban feed system is unique in its scale and contribution to total feed input.

There are enormous differences in the way urban agriculture systems are classified, as is demonstrated in this volume (see Chapter 7, 11 and 12 for example). Classifications differ based on space (intra-urban/peri-urban), based on production objectives (subsistence/semi-commercial/entrepreneurial) and on predominance of crops or livestock and based on size of holdings. Most classifications capture a part of the reality but suffer from overlapping boundaries and geographical variability. In thinking about methods for technology development, it is important to think about the ways that different types of urban agriculture impinge on household livelihoods.

Box 10.1 *Main stages of PTD*

Participatory situation analysis

The first stage of PTD involves different kinds of interactions between "outsider" PTD practitioners and local people in an area which has been targeted for development interventions. This initial stage includes a wide variety of acronyms and approaches (Survey, Sondeo, RRA, PRA, PLA, RAAKS situation analysis, etc) with the level of participation of local people differing considerably. A PTD workshop undertaken by ILEIA (Center for Information on Low External Input and Sustainable Agriculture) in the late 1980s assessed over 200 methods and characterised the first stages as "Getting started", understanding problems and opportunities and "Looking for things to try" (Reijntjes et al., 1992). The key elements of this first phase are: creating favourable conditions; establishing rapport and trust; jointly understanding the local context; identifying key local needs; listing and prioritising the collaborative opportunities that exist for experimentally testing solutions for those needs.

Participatory Experimentation

Once the research opportunities are selected, the process moves to the stage of experimentation, including participatory monitoring. The different degrees of local participation typical of situation analysis also characterise experimentation and joint research. These differences have been formalized into a typology of participation in research (Biggs, 1989):

- Contractual in which researchers contract with farmers for land or services such as labour or use of equipment. This is typically associated with "off-station research", experimentation which seeks to scientifically test technologies under different environments, but with minimal interest in the views and opinions of farmers. The high pressure on resources and the multi-tasking livelihoods strategies of many producers mitigate against this type of researcher-dominated experimentation in urban and peri-urban agriculture.
- Consultative This is agricultural research as a doctor-patient relationship, in which consultation with farmers about problems is part of a structured process determined by researchers, in which decisions about responses to needs and opportunities are also researcher led. Local opinion is usually mediated by field-level staff, social scientists and/or local representatives. This is often the default option, the appearance of participation, but with researchers maintaining control of the agenda.
- Collaborative is a partnership arrangement between scientists and local individuals and groups. Two way learning, in which local expertise is combined with positive lessons and best practices derived from comparative experiences of researchers. It involves an engagement with a wider range of local producers who have a voice, so more egalitarian. It provides an opportunity for addressing diverse technology needs, including those of the poorest groups. It lends increased legitimacy for locally driven development. This is especially important in urban areas where legitimacy for agriculture in general is often weak.
- Collegial. This type of participation actively encourages and seeks to strengthen local-led research and development (R&D), in which experimenting farmers (often informally) take the lead. Because of the very common situations in which migrant households need to adapt to new production contexts in urban and peri-urban areas or new market opportunities, these types of innovative producers are likely to be very common in urban and peri-urban areas, and this type of collegial mode would therefore be very appropriate.

Going to scale: technology and policy innovation at regional and national level

PTD is not just about technology innovation among a small number of farmers who participate in situation diagnosis and participatory experimentation. It incorporates farmer to farmers extension and methods to facilitate the sharing of innovations among a broader group of stakeholders. These include field days, cross-visits, extension messages and replications in other localities. In urban and peri-urban areas, there is a special importance attached to influencing policy, through the involvement of policy makers in PTD activities.

It is helpful to group together systems which mainly contribute in a positive way to household human resources through subsistence and enhanced nutrition, which also contribute in a limited way to the income of the family through small sales, or indirectly, through savings on purchased food. This contrasts with intensive semi-commercial or entrepreneurial systems which contribute an important, though not necessarily the major, part of household income, but because of the urban setting and the intensive methods can have negative health impacts on producer families and on neighbours and consumers. This is also an imperfect division, but it helps to organise thinking about key PTD issues in the urban context. In particular, it focuses attention on substantive differences in the manipulation of space and inputs.

Because of the somewhat different methodological experiences between crop and livestock production, these will be considered separately, even though mixed crop-livestock systems in cities are common and important for maximising recycling opportunities of crop and livestock wastes as fodder or manure.

The extent to which the policy and planning environment interacts with technology development also tends to vary between crop and livestock systems and between these two types of production system. Livestock-raising is subject to greater regulation and policy issues than crop production, and income-focused systems tend to be more policy sensitive than small-scale, "health and income support" systems. Policy factors are considered in a separate section.

Intensification and Sustainability of Urban Horticulture

A key technology development issue for urban horticultural production systems, especially on larger urban or peri-urban plots, concerns the sustainability of intensification strategies that farmers adopt, especially the extent to which these strategies impact on urban environmental health. Intensification of larger-scale urban horticultural systems occurs in at least three different ways with different associated health and environmental risks (see also Chapter 11):

1. Through cultivating high value crops during the off-season, to capture higher prices, through a combination of adapted varieties, increased use of pesticides and/or the use of physical barriers to control or avoid higher pest pressure. Risk factors are pesticide contamination and high cash investment.

2. Through productivity increases on the same land area in the same time period through modern varieties and/or increased use of agro-chemicals. Risk factors are pesticide contamination and nitrate leaching.

3. By maximising the use of available natural resources where these had not previously been used for agriculture, including use of wastewater, as a source of water but also as a source of nutrients (Cornish and Lawrence, 2001; Chapter 9), composted urban organic solid wastes and the use of abandoned or marginal lands, such as old factory or workshop areas, riverbanks or wetlands. Risk factors in this strategy are exposure to pathogens, parasites and heavy metals.

Technology innovation in these kinds of systems needs to adopt a broader urban systems approach to ensure that intensification contributes positively to individual household livelihoods – does not, for example, undermine human capital through pesticide poisoning – and also contributes to a more sustainable urban environment.

Intensified use of limited space

Some of the highest urban population densities are in developing world cities. For example, Manila City, part of Metro Manila, capital of the Philippines, has a population density of

41,000 people per square kilometre, almost ten times that of London. Very often the poorest families live in the most congested neighbourhoods and experience associated problems, such as health and difficulties in securing adequate food and nutrition for the household, because of high food costs. The poorest urban households spend as much as 80 percent of their income on food, up to 30 percent more than is spent by rural families (Argenti, 2000). With urban income frequently based on uncertain, intermittent employment, the possibility of utilising even the smallest spaces for intensive production of vegetables or small livestock can make a major contribution to the overall food security of these households.

Options and methods to maximise the agricultural productivity of minimal space vary along the urban-rural transect, with the greatest challenge existing in the most crowded intra-urban areas of cities where earth itself is lacking. In this situation, evaluation and innovation surrounds the conversion of under-utilised surfaces of the dwelling into mini-gardens.

This is the basis of **container gardening**, also referred to in the Philippines as "receptacle farming" (Undan et al., 2002). Rooftop gardening, as practised in many parts of the world from Manila to Russia to Senegal incorporates container gardening. This production method can provide an accessible and dependable source of leaves, stems, fruits, flowers and occasionally roots to supplement purchased food and to add micro-nutrients to starch-based diets. It takes advantage of patios, window sills, crevices and rooftops to locate any of a wide range of recycled domestic and industrial containers as recipients for soil and plants. Old tyres, tin cans, plastic bottles with the tops cut off, old water buckets, basins, baths, refrigerators and air-conditioning casings, biscuit boxes, fruit crates, bamboo poles, jute or plastic sacks with holes in the sides - the list goes on. As always with urban food production, human health risks need to be monitored in this method. Metal containers or paint cans can be a source of heavy metal contamination affecting humans and in some cases such as zinc, also plants. Metal containers can also absorb too much heat preventing good root growth. Two key technologies influence successful container gardening and need to be carefully evaluated: the type and quality of the planting materials and the quality of the planting medium. The economic benefits of container gardens are usually derived from the saved income from not purchasing vegetables in the market rather than from direct sales (Villamayor, 1991).

Box 10.2 *Choice of crops*

The choice of crops to plant in containers depends on the preference of the household agronomic constraints of the system and availability of seed. Tree species are generally too demanding of space and soil depth to be successfully grown in containers. Root crops can be grown in sacks, known as "gardens in the air" technology (Gayao et al., 1997), but many containers are too shallow for good storage root development. The most common plants for container gardening are vegetables, both erect or compact types such as lettuce, kale, celery, fruiting vegetables such as aubergine and peppers, aromatic plants like parsley, basil, mint etc., and spreading types which can be supported on trellises, such as gourds, climbing beans, chayote (*Sechium edule*), zucchini etc. These species are both well adapted to containers and offer culinary, nutritional and economic benefits for low income inner city households. In terms of human health, vegetables are important sources of micro-nutrients, including minerals and vitamins known to be essential for good health. They are also sources of a range of "phytochemicals" such as anthrocyanins and lycopenes, which are thought to have important health benefits but for which less evidence has so far been accumulated (*Johns, 1999; Deveza and Holmer, 2002*).

For these very low cost systems, accessing low- or zero-cost planting material is of major importance. A key strategy in PTD for facilitating access to planting material is through local seed networks, involving neighbouring households, schools, civil society organisations, agricultural extension services, city health centres and/or other local and national government offices. Social networks, especially linking women neighbours, do exist in urban settings (Arce et al., 2004) and seed transactions, if they don't exist already, can relatively easily become absorbed as a type of exchange in these informal networks[4]. In some cities, such as Dar es Salaam in Tanzania, Dhaka in Bangladesh, Manila and Baguio in the Philippines and Havana in Cuba, formal community or local government seed systems exist which supply seedlings at low prices to container and other types of urban gardeners (Jacobi et al., 2000; Gayao et al., 1997; Hellen Keller International, 1994; Cruz and Medina, 2003).

Indigenous species can more easily be replanted than exotic species, since the saved seed is mostly viable. Among African traditional leafy vegetables (TLVs), *Amaranthus*, *Corchorus* and *Vernonia spp* produce easily harvestable seeds which can be stored and reused, though the period of viability may be limited to as little as six months, and storage practices are sometimes problematic (Poubom, 1999). The production of seed of exotic, temperate vegetables is mostly a specialised activity in limited agro-ecosystems in tropical and sub-tropical regions, and seed must be purchased. Because seed of these species is usually sold in volumes much larger than is needed to plant containers in a small area, these are less commonly found in container gardens and usually linked to a community or local government seed system. Although there is much evidence about informal, reciprocal seed exchanges taking place between small rural households in the literature (eg. Tripp, 2001) there is limited information about exchanges among container and other kinds of urban producer. An early study in Kenya found that this type of exchange exists among different types of urban producers, but more commonly in the larger towns and cities (Lee-Smith and Memon, 1994). A recent study in Lima among small producers growing mainly for the market found that only about1 percent of producers obtain their seed this way, 18 percent reproduce their own seeds, primarily for local species, whilst the main seed source – especially for exotic and/or commercial species and varieties - is the commercial seed sector. Participatory technology development has been actively applied to the field of local seed systems (Scheidegger and Prain, 2000) and could contribute to enhancing access to and management of seeds in urban container gardening and other kinds of urban production systems.

The main factors of concern in managing container media are fertility, moisture control and aeration. A variety of techniques are available, and some examples are described in Table 10.1.

Table 10.1 *Management issues in Container Gardening*

	Fertility	Moisture	Aeration
Container gardening, Mexico (Erdmann 2004)	Urine (N), worm castings and rotting leaves (P,K)	Containers with side drains for bottom reservoir without water-logging. Central stick to test moisture	Use of leaves, grass-cuttings under layer of soil
Container gardening, Philippines (Deveza and Holmer, 2002)	Mixed substrate (2 x loam soil, 1 x compost and 1 x rice hull). Top dressing of composted manure every 2 weeks or rice or meat washing water	Porous structure of the substrate due to rice hull provides good drainage. Regular morning watering	Structure of the substrate with rice hull provides good aeration
Barrel garden, Ethiopia (Getachew), 2003	Mixed substrate (2 x soil, 1 x composted manure, 1 x sand. Weekly application of "manure tea" **(5)**	Slow moisture delivery through central, sand-filled corrugated iron roll; perforated base and standing on gravel	Structure of the substrate with sand and manure providing better aeration

Although container gardens are adapted to densely populated spaces lacking plots of cultivable land, those same spaces are dense in usable nutrients: those deriving from the organic wastes and residues of the local population. Urine was identified as the most effective nutrient in Mexico, and it also emerged as the winner in participatory evaluations in the slums of Tacloban in central Philippines (Villamayor, 1991). Other sources of nutrients include food wastes, leaves collected from city trees and animal wastes from urban livestock keepers who sometimes find problems with disposal of these wastes (Njenga and Karanja., 2005). Evaluations of different nutrient options depend on local availability of organic residues of different types and the interest and resources of the container owner. Often there is either no space or no time for composting of household wastes, so urine is an attractive alternative. Where manure is easily available, as in Addis Ababa, maintenance of a stock of manure tea may be quite feasible.

Gordon Prain

BIG in Ethiopia, just outside Addis

Whether for container gardens or in less dense settlements where people have access to small backyard gardens or to off-site plots such as roadsides, riversides, wetland margins or unused public lands such as railway embankments and under power lines, opportunities exist for intensifying production. Intensification is dependent, as has been mentioned, on the interest and resources of the producer family, but it is also dependent on the regulatory environment. Even with sufficient resources, large investments in hydroponic or organoponic technologies is likely to occur only if there is security of tenure and supportive local policies (chapter 3, this volume). These issues are discussed in more detail in the final section of the chapter. In this section, alternative methods are briefly introduced which offer minimalist, low-cost solutions to intensification under constrained space conditions and often in an uncertain regulatory climate and informal social organisation.

Bio-intensive gardening seeks to intensify and diversify production through low-cost improvements in crop, seed and variety selection and sequencing, plant nutrition, soil management and pest management (Getachew, 2002; Chapter 11 this volume). The approach has a long history as a strategy for rural food and nutrition security (IIRR, 1991), but more recently it is being applied to the urban context. Bio-intensive urban gardens, in addition to the emphasis on enhanced nutritional quality of the food produced, adds a concern with food safety, given the increasing commercialisation of vegetables from high input peri-urban and truck farming systems. There is a strong emphasis on crop management and especially soil management, through simple techniques such as "basket gardens" and more labour intensive "double digging" of the garden bed with a mixture of 50 – 100 percent compost, for enhanced productivity (See the Case of "The Living Garden", Chapter 11, this volume).

The "pyramid" gardens introduced in Kampala and other cities are examples of the importance of manipulating vertical as well as horizontal space as a means of bio-intensification of small urban plots (cf. Niñez, 1984). Through collaboration between the Kampala City Agriculture Office and local women gardeners, pyramid-shaped structures have been constructed, using compost-enriched earth held in place by chicken wire and sacking. Holes are made in the sacking both horizontally, around the structure, and vertically, with the top part left open for additional planting. Such an arrangement allows the growth of many more plants than could be grown in a flat bed.

These practices are simple adaptations of two livelihoods realities present in many poor households in Addis, Kampala and in other cities in the developing world. On the one hand it is the common practice of planting horticultural crops in any available planting space, to supplement household food supplies and reduce cash expenditures on food, however modest. On the other, it is the existence of "hidden" household physical or natural capital – vegetative and animal organic wastes – which instead of being perceived as a nuisance and a burden, can be co-composted for use as soil nutrients to improve horticultural productivity. In Ethiopia, this simple connection has been made through hands-on practical training courses in bio-intensive gardening and through incorporating this and other types of bio-intensive technologies into NGO activities in and around Addis. In the case of intensive gardening in Kampala, although their introduction and use has been a result of close cooperation between the City Agriculture Office and women gardeners, the ambiguous status of cultivation in the city, with several by-laws prohibiting aspects of agriculture still in existence into the 21st century, the large-scale diffusion of these approaches has been inhibited, at least until a recent participatory review of the by-laws and ordinances and their revision by the City Council (DFID, 2006).

Urban horticulture as an income source and health risk: intensification and sustainability

A second, broad category of crop production systems in urban and peri-urban areas are those that seek to take advantage of close by, diverse markets through shorter growing seasons, higher yields and the production of the most profitable commodities. In this commercial intensification, these systems can interact in a number of negative ways with the urban environment, creating health risks to both producers and consumers and therefore becoming unsustainable. Risks include pesticide contamination, nitrate leaching, exposure to pathogens and parasites and contamination from heavy metals.


Bert Lof

An integrated hydroponics system at Growing Power, Milwaukee

Technology innovation in these kinds of systems needs to adopt a broader urban systems approach to ensure that intensification contributes positively to individual household livelihoods – does not, for example, undermine human capital through pesticide poisoning – and also contributes to a more sustainable urban environment.

Farmer Field Schools, an approach which was developed for rural agriculture, has attempted to focus on eco-system learning and sustainable production systems, especially through integrated crop management.. It seems very appropriate for adaptation for use in urban conditions.

The Farmer Field School (FFS) method applies adult education thinking and experience to agricultural learning and change. Adult education has grown in importance as educators have recognised that the accelerating pace of technological change means that the tools one acquires in formal pedagogic education **(6)** become quickly obsolete in adult life (Minnick, 1989). FFS was developed initially to facilitate farmer understanding and application of integrated pest management principles in rice farming, for which conventional technology transfer training approaches were found to be inadequate (Röling and van de Fliert, 1998) and it was successfully introduced into rice farming in Indonesia and other Asian countries (ibid).

FFS has been applied to a broader range of crops, such as vegetables and has become less specifically focused on IPM, especially in cases where it is applied to crops with less stable demand and less clear agronomic constraints, such as sweetpotatoes in Indonesia (Braun et al 1997). This has led to considerable adaptation of the original production-side, crop constraint focus, with more attention to soils, markets, local learning and organization and farmer empowerment (Röling, 2003; Züger, 2005). In particular, it is possible to see how FFS is becoming more closely aligned with a livelihoods perspective, and less strongly tied to crop protection. In the words of Niels Röling, FFS is "a form of agricultural education that develops 'human and social capital' while conserving 'natural capital'" (ibid). This evolution of FFS seemed to align it very well with the livelihoods framework which is being increasingly used in urban agriculture research (Urban Harvest, 2004). The basic principles of the Farmer Field School, distilled from 10 years of Asian and other experience are listed in box 10.3 (adapted from Pretty, 1995)

Box 10.3 *Basic principles of FFS*

- What is relevant and meaningful is decided by the learner and must be discovered by the learner.
- Learning flourishes when teaching is seen as a facilitating process that assists people to explore and discover
- Learning is a consequence of experience ('learning by doing'). The field is the best learning site
- Cooperative approaches are enabling. They can strengthen learning (social learning, farmer-to-farmer learning) and as people invest in collaborative group approaches, they develop a better sense of their own worth
- Learning is an evolutionary process and is characterized by free and open communications, confrontation, acceptance, respect and the right to make mistakes
- Each person's experience of reality is unique. As they become more aware of how they learn and solve problems, they can refine and modify their own styles of learning and action

FFSs provide the setting and the materials for farmers to explore and discover for themselves new knowledge about agricultural production on the presumption that knowledge actively and repeatedly obtained in this way will be more easily internalised, retained and applied after completion of the training. Repetition is important for retention, which is one reason why FFSs are repeated, usually on a weekly or fortnightly basis, with the same structure, throughout the growing season.

Though some of these elements are as relevant and important for urban agriculture as they are for agriculture in rural conditions, some have special resonance in urban conditions. The approach requires a major time commitment by FFS participants which can be problematic in urban conditions where agriculture may be only one of several livelihoods activities.

Until recently the application of this method to urban conditions was largely untested (Prain, 2001). Yet it appears to offer the possibility of mitigating the negative consequences of intensification referred to above through safely and sustainably increasing the use of organic wastes for soil conditioning and plant nutrition and improving the management of pests and diseases through integrated approaches, leading to improved crop quality and food safety which are increasingly contentious issues in urban agriculture. It also offers the means to relate crop production to the broader socio-economic, institutional and policy arenas.

Case 1 of this chapter provides an example of the adaptation of FFS to urban horticulture in Lima, Peru. It shows that time is more of a constraint in urban settings and commitment is perhaps more closely linked to commercial opportunities offered by participation in the school. FFS also places strong emphasis on social interaction and learning, involving group activities. This can present difficulties in urban contexts where limited trust and social capital exist among urban cultivators (Arce et al., 2004). Yet as this case makes clear, though weak social linkages and other, urban-specific factors necessitate special attention at the beginning of the FFS process, the process itself provides a positive means to establish and strengthen social and communal ties within cities.

The case describes a project which was launched in 2004 by Urban Harvest and involved multilateral, national public sector, NGO's and community participation to mitigate urban poverty in the low-income eastern shanty towns of Lima through agriculture. Lima. The general objective of the project is to contribute to reduced urban poverty, improved food and nutrition security and a more sustainable urban environment through participatory, urban-adapted innovation in crop and livestock technologies and capacity building of the local population in sustainable and healthy urban food production . The experience of Farmer Field Schools within the CGIAR and especially within the International Potato Center, which convenes Urban Harvest, offered a model to address both urban-adapted innovation and farmer capacity building.

Urban and Peri-urban Livestock Raising: methods for addressing needs and mitigating risks


Marielle Dubbeling

Goat keeping in Kampala

Throughout the developing world, and especially in Africa, animals are an important physical and financial capital for many urban and peri-urban households. They may be a regular or periodic source of income through sale of milk, eggs or off-spring, and they represent a form of savings which can be cashed-in if a crisis occurs. Animals also generate additional physical capital in the form of manure, either for sale or for improving the household's crop production system. Livestock are thus key components of livelihoods for many families and improvements in growth rate, health status and meat quality and/or reduction in costs of production through alternative diets using locally available ingredients can contribute directly and significantly to livelihoods (ILRI, 2005). On the other hand, keeping animals in the often cramped conditions faced by many peri-urban and especially urban producers is a potential health risk, not only to the producer's family, but also to neighbours and consumers (Birley and Lock, 1999) and chapter 12).

Yet in both rural and urban contexts, PTD for livestock has a much shorter history than for crops. A search on the internet for PTD in relation to crops and crop varieties, seed, soils, pests and diseases returns 5.5 million pages as opposed to 94,000 for PTD and animals, livestock and/or specific types of animals. Although situation diagnosis and analysis often includes livestock-raising and crop-livestock interactions, and looks at economic risks of the business, it less commonly incorporates environmental or health risk assessment associated with integrated systems. There are also far fewer cases of participatory experimentation for technology development. This is partly due to the fact that livestock research is still very much scientist-led and experiment-station based (DfID, 2005; Conroy, 2004), more so than crops research. Conroy also comments on another tendency within livestock research – to address the problems of, and work with, large-scale, commercial animal production and product enterprises, rather than addressing the often very different problems and needs of small-scale livestock keepers.

However, there are also methodological difficulties with participatory research with animals. Situation analysis may require different kinds of sampling, to capture different sizes of enterprises involving different kinds of animals and the variability of herd size over time, as well as including non-livestock keepers (See Case 2). This tends to favour the use of modelling, which allows the possibility of including these multiple variables, at lower cost. Where health risks are part of the diagnosis, minimal data on exposure to risk may require diverse sampling of animal substances and products. Although these difficulties also apply to situation analysis involving health risks in crop production, these are far fewer, and the more limited physical contact between human and crop reduces the exposure risk. The importance of exposure risk in livestock keeping suggests that there is more of a need for complementarity between participatory and non-participatory methods. In many cases, laboratory assessments, for example, need to be considered a component of the PTD process. Some of these issues are listed below.

- Experimental comparison of different technology options, such as animal cohorts undergoing alternative feed regimes, is complicated by several factors not present in the case of crops;
- Space constraints on-farm, limiting number of technology options or number of animals per option, which weakens the conclusions that can be drawn;
- Livestock management limitations, such as ensuring that "technology options" do not walk into each other's pens, thus confusing the conclusions that farmers and researchers can draw;
- High value to households of individual animals, leading sometimes to sales ahead of the completion of the trial;
- Practical difficulties and costs of periodic weighing on farm;
- Negative attitudes of local authorities or neighbours to the participant in research;

Many of these methodological problems are even more severe for urban livestock-keepers, where space is often more limited and the separation of technology options or treatments more complicated and where potential health risks from close animal-human interactions and the difficulties of disposing of animal wastes are greater. This tends to place greater importance on the use of statistical techniques to overcome these constraints.

The policy and regulatory context is often more difficult in urban settings, with controls or prohibitions frequently applied to livestock raising, leading to insecurity. Nevertheless, there have been some recent developments in introducing PTD into smallholder livestock research and at the same time reviewing the policy context in which technical improvement is taking place [7]. The rest of the section illustrates these developments in Vietnam, Uganda and Lima.

Participatory experimentation: pig nutrition in Hanoi, Vietnam.

Feed is the main direct expense for pig-raising households in Hanoi, after the cost of piglets. Thus farmers seek ways to reduce their costs whilst maintaining or improving the health and growth rates of their animals. Situation diagnosis in a rural-urban transect linking Hanoi with its rural hinterland found three distinct pig production systems: mostly rural production of piglets, with sows fed on available agricultural residues, especially sweet potato vines; commercial fattening of pigs over about 30 kilos, mostly in the urban and peri-urban areas, and increasingly dependent on use of restaurant and other food residues from the city; in between these two systems, there is the specialised raising of young pigs (*got*) from about 7 kilos to about 30 kilos. This is the most entrepreneurial system, in that it carries higher risks from disease, but also higher potential profits. Profitability is related to growth rate, as well as the healthy, chubby appearance of the animals at sale, and these factors are highly influenced by diet. The original diet was based on purchased rice, rice bran, concentrates and a small amount of forage, mainly sweet potato tops. These inputs, most of which are enmeshed in a complex credit system, suffer significant price fluctuations, making the pig-raising family vulnerable to losses.

Furthermore, the rice needs to be cooked, thus increasing the costs and the labour investment. The PTD intervention in this context consisted in evaluating alternative, local feed sources, both for energy and for protein. In a series of three rounds of trials, two or three options or treatments, discussed and developed with the farmers, were compared with the current feed combination. Once again, as occurred in the example of Kampala, there is need to help construct a strong social network among farmer participants to establish a trusting environment within which to pool existing knowledge and experience and to ensure continued interest in participation. This was achieved through orientation and consultation meetings, sensitisation workshops, group evaluations of interim results and the encouragement of regular interactions among those involved in the trials. In Vietnam, there is a very strong local government system which supports to some extent the organisation of this kind of intervention, but there is also a need to create legitimacy for the intervention among the local cadres. An effective means to achieve this is through regular presentation of results to the local authorities and involvement of local authority representatives in knowledge exchange visits to other sites. This is important in any PTD intervention, but in political contexts where the local authorities control outsider access to households, it is essential. (Peters et al., 2002; Tinh, 2004).

Building capacity, institutional dialogue and policy support: Livestock groups in Lima and Nairobi

Container roof garden in Manila, Philippines

Within an urban livelihood framework, participatory technology development cannot be separated from PID: participatory institutional development. This is especially important for livestock-related PTD which is the target of much local regulatory attention. PID includes the need for capacity building, both to enhance efficiencies and to build awareness about safety and health issues. In Lima, a key component of capacity building for livestock production involves familiarisation with key indicators of animal health, development and feed needs and the maintenance of livestock registers, using the indicators to monitor growth and improve performance. This monitoring process is also being used by the R&D team to identify tendencies, in terms of feed use, health status or growth rate to propose technology intervention options. At the same time, this hands-on capacity building provides the basis for group formation around particular livestock and eventually formation of legal associations. This is part of a strategy to strengthen the capacity of local livestock keepers to link to new markets. Group formation can be a new process, working with independent households, or can build on existing structures, for example schools, churches or, as in the case of Lima, community kitchen-based women's groups. This group formation is closely linked in turn with institutional analysis, learning and change at the level of the local government, involving elected and appointed officials and representatives of other sectors (Arce, 2006).

In Nairobi, where urban and peri-urban livestock keepers make a major contribution to satisfying the city's demand for milk (Staal et al., 2002), they are also rather isolated from government services and vulnerable to regulation and harassment. In 2004, the Nairobi and Environs Food Security, Agriculture and Livestock Forum (NEFSALF) was established to:

- "drive the sectoral mix and interactions" among producer communities, government agencies, local government, the agricultural research community and the market, thereby improving institutional recognition and supporting commercial opportunities;
- acquire and target relevant knowledge;
- monitor process and monitor outcomes.

NEFSALF provides a platform to facilitate access by the community to provincial and municipal services and to open a dialogue with the City Council. It also provides the space for capacity building in key technical, health and policy areas, provided by public sector specialists. Currently the forum brings together 15 community groups mostly involved in mixed crop-livestock farming, government ministries, NGOs and local government representation (NEFSALF, 2005).

Integrated urban management of local agricultural development

In the urban setting, agriculture is one strand in a complicated web of activities in which households are engaged in pursuit of their livelihoods. Participatory technology development needs to assess the direct impact of innovations on household capitals and potential feedbacks to the urban ecosystem, affecting the capitals of other families. As the livelihoods framework makes clear, these innovations are also filtered through local institutions and policies which are more pervasive and invasive in urban areas than in the countryside. Urban PTD has a better chance of success if agriculture forms part of an integrated approach to urban development, with a supportive and enabling institutional and policy environment.

A useful example to consider, in which PTD has proceeded within an enabling policy environment, is Cuba . As Case 3 discusses in more detail, the growth of urban agriculture in Cuba and the uptake of innovative technologies have been dramatic and impressive. In just over ten years, between 1989 and 2000, it moved from a marginal component in urban food systems to a major category of land use in Havana and other cities, a major employer of urban labour and an important source of micro-nutrients for the urban population. It has also greatly reduced the accumulation of organic wastes in urban dumpsites.

Among the many instances of technical innovation which have accompanied this agricultural transformation, "organoponics" – the large-scale construction of raised beds for vegetable production using an enriched substrate of soil and organic matter – is a particularly important illustration of how institutional and policy integration facilitates technical change. Organoponics involves spatial intensification through the utilization vacant lots – frequently the concrete surfaces of demolished buildings. Facilitating this intensification are a series of policy changes about access to land, marketing of products and the structuring of the employment market. Bio-intensification, through an adaptation of the raised bed and double-digging techniques and the application of high levels of organic matter is again supported through institutional and policy mechanisms involving access to waste building materials to construct the beds and the provision of transport services to bring the large quantities of organic matter from the rural to urban areas.

Technologies do not stand alone. They need to be adapted not only to local ecological and socio-economic realities, they also need to be compatible with and supported by the local institutions and policies.

Concluding Remarks

Two important lessons emerge from the cases and experiences discussed in this chapter. For urban agriculture to be viable and sustainable, innovation needs to occur in the context of urban livelihoods, in which agriculture usually complements other employment and where agriculture contributes to and draws on the diverse set of capitals making up the household asset base.

Innovation also needs to occur at technical, institutional and at policy levels and to involve households, communal organisations and city authorities. It is this need for multiple innovation which seems to be more essential for urban than for rural agriculture. Cuba exemplifies not only the contribution of the city authorities to technical innovation in the organoponic gardens, but also the provision of a facilitating policy environment, in the form of relaxed restrictions on private access to and exploitation of land, new marketing systems and support for establishment of local level organisations (see the thrrd case).

Less successful aspects of the Cuban experience highlight other key elements of urban agriculture that need to be fostered. Technical, institutional and policy innovation need to result from participatory dialogue and negotiation, rather than being imposed by a single actor in the process. For instance, in Cuba there has been a tendency to impose a uniform use of high-yielding varieties, through a centrally-organised seed production system, even though experimentation with local land races or mixed varietal plantings could lead to benefits in some systems. Furthermore, there are indications that though urban agriculture has successfully produced food for several cities, it has not always become a well-integrated part of those cities. In the words of two Cuban writers, there is a lack of "harmony between the productive space and the constructed space" (Cruz and Medina, 2003). These observations raise an increasingly important theme in the urban agriculture discourse in both the North and the South. This concerns the multi-functionality of urban space and the opportunity for agriculture in the urban setting to fulfil multiple roles for the urban community (Chapter 1 and 7, this volume). The environmental contribution of agriculture has been widely documented. Already there is evidence that the psycho-social space which agriculture provides to poor households and communities in the city, and especially to women, can sometimes be as important as its food security or income role (Slater, 2001). Experiences cited in this chapter suggest that through the medium of field schools, urban agriculture can be a means for social organisation. There are also opportunities for agriculture to function as a source of child and youth education about natural processes and resources, as a locus for family recreation, and a major contributor to the sustainability of cities.

Notes

[1] This is not to imply that rural livelihoods are exclusively bound to farming. There is also diversity in rural livelihoods, but agriculture is still by far the dominant activity and often the only one (cf Ellis, 2000).

[2] In chapter 6 the authors identify seven capitals to illustrate Community Building Urban Agriculture (CBUA).

[3] Tropical slash and burn or swidden agriculture is an important system that also manipulates vertical space (Conklin, 1975).

[4] Nevertheless, social networks and other types of social capital may be less common in urban settings compared to rural communities (Stren et al., 2003)). This is discussed further in section below.

[5] Manure dissolved in water.

[6] Pedagogy literally means "to teach children".

[7] The work of DFID's Livestock Production Programme (LPP) has made an important contribution

to bringing participatory research into the mainstream of livestock programs in the developing world. See DfID 2005. The International Livestock Research Institute (ILRI), through its Small Dairy Development Program, has also tried to incorporate a participatory approach and to work with the small, informal sector where most dairy production takes place in Africa (Staal, 2002), and there are other examples.

[8] This can be resolved through drawing a statistically random sub-sample from the survey sample.

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The Farmer Field School (FFS) method in an urban setting: a case study in Lima, Peru

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Maarten Warnaars

Background

In 2004, a project to mitigate urban poverty through agriculture was launched in the low-income eastern shanty towns of Lima and used the Farmer Field School (FFS) methodology adapted to an urban situation. Lima is located in the coastal desert of Peru and has one of the lowest rainfalls in the world. Water for domestic, industrial and agricultural uses is mainly supplied from the three rivers which flow from the Andes Mountains to the northern, eastern and southern zones of the city. The Rímac river in the eastern zone irrigates about 4500 hectares within metropolitan Lima, from the Andean foothills to the central parts of the city. Small plots are used by urban producers primarily to grow leafy, root and fruit vegetables, maize and aromatic herbs and to raise small animals, including pigs and dairy cattle. Back-yard crop production and livestock raising are also undertaken on a much smaller scale by shanty-town dwellers with no access to irrigation water.


Gordon Prain

Farmer Field School in the eastern cone of Lima, Peru

Field School Implementation

Participatory workshops, consultations with producers and a baseline survey indicated widespread use of highly toxic pesticides and limited knowledge about integrated crop management practices. There were also widespread marketing problems. Based on these findings, the broad goals of the Lima FFS were:

1. To build the capacity of producers to better analyse the local agro-ecosystems so as to manage vegetable crops more sustainably;
2. To undertake participatory evaluation of crop management innovations; and,
3. To strengthen producer capacity for social organisation for improved marketing and other objectives.

Previous livelihoods assessments (Maldonad, 2004) clearly showed low levels of social capital among the producer families. There was limited participation in associations and low levels of communal action – less among men than among women. This meant that more time had to be invested in preliminary group sensitisation meetings and in group dynamics than is necessary in rural contexts where field schools are often embedded in existing social structures.

To address this situation, a "pre-school" phase was implemented, involving joint meetings during which the principles and ideas of the FFS were explained and discussed with a large group of both female and male producers. From this group a smaller number of producers who demonstrated a willingness to participate in the weekly half-day meetings throughout the growing season, which the method calls for, was identified. Another meeting was held with these FFS members to agree on commitments, norms and rules for the implementation of the FFS and to define the thematic programme.

This preparation period took nearly three months, much longer than anticipated and certainly longer than is usual for FFS implementation in rural areas. This was partly due to the complexity of the vegetable farming systems in the area, but also due to the diversity of interests of the group, the novelty of the approach for them, the diversity of non-agricultural activities in which they are involved and the need to build consensus and agreement on the curriculum. The process involved many different types of sensitisation meetings, workshops and cross-visits.

Based on these discussions, the FFS programme and curriculum was established. The programme consisted of the seven stages, which are slightly different from the "classical" FFS structure, and reflects a perceived need by the facilitators to emphasize review and continuity in each session, to ensure commitment over time and to reinforce learning (Table 10.2).

Table 10.2 *Comparison of urban FFS session structure with the classical structure*

Urban Field School session structure	"Classical" FFS session structure
Welcome	Welcome
Review of previous week's session Review of week's tasks	Field observation: observation of crop in field Agro-ecosystem analysis: interpretation of observations
Analysis of the agro-ecosystem	Presentation of results and discussion
Key theme of the week	Economic analysis: income implications of presence of threats and responses proposed
Agreements for coming week	Group dynamics: strengthen social and communal elements
Evaluation of the session	*Special topic*

With this overall structure for each session, the curriculum encompassed several learning points for the different sessions. These learning points linked to and drew on experiences in the project's activities such as market chain analysis, water quality studies and small animal keeping.

Box 10.4 *Modules of the FFS*

- **Session 1** Confirmation of organisation and norms. Feedback on results from the baseline survey, especially regarding the target crops of lettuce and beetroot. Development of a timeline for production of lettuce and beetroot to guide the themes of other sessions.
- **Session 2** Plot testing and selection of plot for FFS activities.
- **Session 3** Discussion of soil management, using novel tools to dramatise the relation farmer/soil and seed quality, focusing on the importance of good quality seed for better germination. Discussion of trials to be conducted during the season: establishment of plots for comparison of locally available manures (chicken, guinea pig and cow); comparison of row sowing and bed sowing; comparison between one field plot with integrated pest management (IPM) and one with farmers' practice; parameters for evaluation; yield.
- **Session 4**. Planting trials. Discussion of plant nutrition and use of fertilisers.

continuation of **Box 10.4**

- **Session 5.** Analysis. Agro-ecosystem analysis with special attention to the problem of fungi that cause Fusarium wilt disease. Development of design for double digging method. In the discussions of double-digging, attention is paid again to "soil health" and the use of the different composts and manures, emphasising that plant health depends on soil health.
- **Session 6**. IPM. Understanding of cultural, biological, mechanical, physical and chemical control methods. Practical control methods such as yellow traps and biological control.
- **Session 7**. Organic fertilisers. Use of composts and preparation.
- **Session 8**. Principal insect pests and biological control of these pests in horticultural crops.
- **Session 9**. Horticultural crop diseases and the use of fungicides
- **Session 10**. Marketing. Identification of marketing channels and their characteristics in the zone. Identification of new market niches. Production planning in terms of market demand.
- **Session 11**. Preparations for field day. Demonstration of learning achievements during the FFS process. Defining means to inform wider population. Field day, involving several "stations" manned by Field School participants, at which visitors learn about the different topics covered in the sessions. The presence of municipal representatives and introductory talks emphasised the integration of agriculture within urban planning and development.
- **Session 12**. Vegetable packaging. Product presentation and price effects.
- **Session 13**. Economic analysis. Understanding profit and loss accounts of local producers. Analysis of production costs.
- **Session 14**. Evalution This is undertaken to assess the usefulness of the different themes included in the FFS and evaluate group learning over the period of the FSS.
- **Session 15**. Water and irrigation systems. The relation between water, soil and crops. Different irrigation systems, including drip irrigation and the use of treatment reservoirs with the opportunity for aquaculture with tilapia and the production of clean irrigation water.
- **Closing Ceremony**. Re-emphasis of the integration of agriculture in urban development through the involvement of the mayor in presentation of awards to graduates of the FSS.

Learning points

- So far, two FFSs have been completed in two localities of the eastern zone of Lima, one using beetroot and lettuce as the target crops, the other focused on lettuce. A total of 23 producers have completed the schools.
- Whereas in rural areas the location of the communal activities of the FFS on an individual's private land has not been problematic, this has been an issue in the urban field schools. Participant producers expressed interest in accessing a neutral space for continued experimentation and learning. Municipal land was assigned for use as a "School for Urban Farmers". This "school without walls" provides a stable location for on-going evaluations of alternative technologies by the FFS graduates themselves. It also demonstrates alternative production practices to other producers and is a visible recognition of the necessary integration of agriculture within municipal policy and practice.
- The School for Urban Farmers has the potential to offer multi-functional services to the local population. These can include income, food security and therapeutic options for vulnerable groups such as unemployed youth, pensioners and the sick. It is also an excellent site to provide environmental education for local schools.
- As part of the sensitisation process and the group dynamics of different sessions, a wide range of innovative learning tools and approaches were adapted to the urban characteristics of the FFS group. Tools such as "social drama", which enacted the relationship between "the farmer and the soil", helped to strengthen links to

urban natural resources and their conservation and to strengthen the resolve of local producers to maintain their land for agricultural production rather than selling it for conversion to residential or industrial use.

- Field data obtained from trials undertaken as part of the FFS suggest that integrated practices, especially double-digging, resulted in yield increases of 15 percent for lettuce and 22 percent for beetroot.
- Applications of chemical insecticides were reduced from 2-3 applications per crop in the "farmer practice" treatment to zero applications in the integrated crop management (ICM) treatments, although herbicides continued to be applied in the latter.
- Preliminary results demonstrated the potential to reduce reliance on chemical insecticides while increasing yield
- A complementary study which compared the perception of time and other variables among participants in rural and urban FFSs (Warnaars and Pradel forthcoming) yielded the following main findings:

    o Urban participants were found to be more "time constrained" than their rural counterparts, mainly because of a larger number of demands on their attention and commitment. This confirms the need for a more elaborate sensitisation and consultation period in preparing the FFS and agreeing on the ground rules.
    o Rural participants valued the FFS more highly than their urban counterparts. This seems to reflect the much greater involvement of rural participants in agriculture as their major – and often only – livelihood activity.
    o Both urban and rural participants highly appreciated the FFS as an organisational tool and a means to secure social cohesion, though this may be more marked among the urban participants.
    o Both sets of participants wanted their children to pursue an education and did not see their children staying on in agriculture. This clearly reflects both the cultural devaluation of agriculture as an occupation in Peru, and the economic constraints faced by most agricultural producers under present technical capacities and marketing conditions. It highlights the need for re-valuing agriculture as a complementary livelihood activity and seeking increased profitability from technical innovation, alternative crops or animal products and the identification of new market opportunities.

- The positive impact of the FFS was demonstrated by the significantly increased knowledge of ICM principles demonstrated by participants and the adoption of ICM practices on their own farms
- The positive impact of the FFS was also demonstrated in the increased social capital of participants and their empowerment to seek institutional change. Both FFS groups have formed themselves into agro-enterprise associations to market ecological products.

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Situation Analysis and Health Risk Assessment: Cattle and poultry raising in Kampala

Gordon Prain

The Study

Livestock production within urban and peri-urban agriculture offers a wide variety of potential benefits (see also chapter 12). However, these benefits must be weighed against the potential negative effects of urban livestock production. The findings of a study in Kampala that examined the economic and health consequences of raising animals in the city are summarised here. The study was conducted among livestock keepers and included a sample of urban households that did not keep livestock (referred to as non-livestock keepers) as a control.

Sampling of the three groups (cattle keepers, poultry keepers and non-livestock keepers) required preliminary and extensive key informant interactions, and helped to establish representative focus groups. Local knowledge and the residents' lists managed by the parish officials were used. In contrast to relatively homogenous rural communities, urban households tend to be more heterogeneous, having extremely varied livelihood activities. In this context it was essential to tap into local knowledge and the local social capital.

Gordon Prain

Pyramid garden and container gardening in central Kampala

The information gathered through the focus group discussions was used to prepare a formal survey. Trade offs had to be made between statistically adequate sampling for the formal survey and the financial and organisational limitations on sample size for the health impacts assessment, which required taking a range of bio-physical samples (blood, milk, eggs). The collection and laboratory analysis of samples was necessary to verify health risks and to suggest participatory technology development (PTD) options. This underlines the interdependence in certain cases between participatory and non-participatory methodologies.

Cattle

The preliminary qualitative assessment identified cattle as the second-most important species for livestock activities in all areas of Kampala, after chickens. The benefits were ranked by focus group participants as follows: milk for cash income and home consumption; cattle sales (often for payment of dowry); manure for sale or use; employment creation. Milk production was clearly the most important benefit and this held true for both urban and peri-urban areas. Selling cattle, including for bride price payments, was considered almost equally important, especially in the urban areas and in some but not all peri-urban areas. Producing manure to sell or use in their fields was considered quite important by farmers as a secondary benefit in the peri-urban areas, but less so in the urban areas. Just over half (51 percent) of the households said they obtained more than a quarter of their household income from keeping cattle, particularly from the sale of milk.

Among the risks associated with cattle-rearing, the focus groups cited environmental pollution, accidents caused by cattle, straying of cattle in the neighbourhood leading to conflicts, low returns compared to farm inputs, flies being a nuisance, and zoonotic diseases. The zoonotic diseases specifically mentioned were tuberculosis (*akafuba*), brucellosis (*okusowola*) and tetanus. When the risks were ranked according to their perceived public health and economic importance, tuberculosis and brucellosis were ranked the highest.

Grace Nabulo

A farmer in Kampala who supplies a big supermarket in Kampala with green vegetables

These focus group findings were well-supported by the separate, in-depth qualitative studies of livestock keeping households using transect walks and in-depth interviews in two urban and two peri-urban parishes, and also by the formal survey. In all four areas, cattle were mostly kept in stalls or sometimes tethered, allowing women to supervise them while performing other domestic activities. Herds of cattle only occurred in the peri-urban areas. In the most rural of the peri-urban areas, cattle grazing on roadsides were being managed collectively by hired herders, while in a more densely settled peri-urban area herds grazed on open land at a community centre.

Most respondents from both cattle-rearing and non-livestock keeping households were aware that consumption of raw cow's milk is risky, though they were not aware of the specific zoonotic diseases or drug residue hazards associated with raw milk. Despite this common awareness, consumption of raw milk was significantly higher among non-livestock households than in cattle-rearing households, suggesting that in the case of the non-livestock households awareness of risk did not necessarily lead to abstention. On the other hand, cases of household members diagnosed with brucellosis, which were reported in three of the cattle-keeping study households and the fact that 21 percent of the livestock households reported abortions in cattle, which can be a symptom of brucellosis, may represent sufficiently strong evidence of risk to lead to higher levels of abstention in these livestock households. Furthermore, only two out of 150 cattle-rearing households reported having vaccinated against brucellosis.

The situation analysis indicated that consumers of milk produced within Kampala District are at risk of exposure to both anti-microbial drug residues (â-Lactams) and zoonotic pathogens. Whereas some awareness exists that milk may be associated with health risks, the majority of those concerned knew little about the specifics of the various disease hazards, especially from anti-microbials. General ignorance of the latter and lack of effective control measures can be expected to contribute to cases of anti-microbial drug resistance (especially of â-Lactams) and allergies associated with such residues in foods (milk) in the city. With respect to zoonoses, this prospective study found a relatively high prevalence of brucellosis in cattle and the presence of *E. coli* in milk, indicating the need for more in-depth risk analyses and impact studies of these public health hazards, to guide the design of PTD, educational and/or policy interventions.

Chickens

Qualitative assessment of chicken-rearing activities indicated three categories: keeping layers for egg production; providing feed inputs to raise improved breeds as broilers for sale of live birds; and raising small flocks of local breeds using feed or scavenging. The third category also includes the sale of live birds. The focus groups identified benefits derived from rearing chickens and then ranked them using the pair-wise ranking technique. The general pattern that emerged across the different focus groups found the principal benefits, in decreasing order, to be: income generation; supplementary food for the household; and a source of manure.

Generally, Kampala households prefer eating the local free-range chickens and selling the improved breeds. The contribution of chicken production activities to household income varied between 19 and 76 percent, with a median of 38 percent. A pathway analysis of the production and marketing chain indicated perceptions such as the contradictory role of the municipal authorities (Kampala City Council) and the poor service provided by the veterinary drug sellers, including the high costs of the drugs. Also, marketing of chickens and eggs is sometimes performed by middlemen, which generates employment but also increases opportunities for contamination and human exposure to health risks.

The separate in-depth study on livestock production also confirmed the focus group findings for poultry keeping. Chickens were the most common form of livestock in all four areas, with all households keeping free-range local chickens for home consumption and more households raising exotic or "improved" breeds for sale of eggs or broilers. All households noted that the exotic breeds were more prone to disease although higher in productivity, and that the production of poultry for sale of eggs and live birds was on the increase in their area. Households rearing chickens in the two urban parishes appeared more conscious and concerned about diseases transmitted by livestock to humans than in the two peri-urban areas, with farmers in the central urban area even concerned about disease transmission from humans to chickens. They noted that keepers with flu could infect birds making them sick and unlikely to breed well and avoided contact with their chickens when they were ill.

George Nasinyama

Cowshed in Kampala

Women are the main caretakers of chickens in the household, (65 percent of the survey sample) and for 47 percent of respondents it is their main activity. For more than 80 percent it is a year-round activity with high rates of investments in vaccination.

Hygiene practices suggest that potential exposure to disease may be substantial. One in ten chicken-rearing households keep the chickens in their living quarters, and a slightly higher proportion allow the chickens to mix with other livestock. Less than a third wear protective clothing when working with their flocks.

Unfortunately, loss of the egg samples collected from the households due to spoilage prevented exploration of the correlation between the risk factors and the prevalence of one of the most common disease factors, salmonella. As a proxy for observations of the pathogen, the study documented reported incidence of enteric illness in the household in the two weeks preceding the interview. Although the use of the proxy suggested that keeping chickens does not contribute to significantly higher risk of enteric disease in Kampala, caution should be exercised in interpreting this result, given the poor quality of the proxy measure used and the small sample size.

In Summary

The central role of women in managing chicken enterprises may imply their higher exposure to potential zoonoses carried by the birds. Although observations suggested that such risk may be exacerbated by poor hygiene practices in many households, this was not confirmed by statistical analysis. The exception was when chickens were allowed to mix with other livestock; in this case statistical analysis confirmed that the practice contributes to higher incidence of enteric illness. The results of the analysis suggest that food practices in the household play at least as important a role as household chicken production in the risk of enteric disease. Specifically, eating raw eggs is associated with enteric disease, while eating meat-derived protein – including local chickens - and not eating leftovers are associated with lower levels of enteric disease. Finally, the linked study of livestock production systems suggested there might be higher awareness of health risks due to potential transmission of zoonotic diseases among the urban than among the peri-urban chicken farmers. These findings suggest the importance of PTD and educational interventions in poultry management and in household hygiene.

Note

[1] Based on Nasinyama et al 2004; Randolph et al., Forthcoming and Dimoulas and Walner-Toews, Forthcoming.

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Integrated Urban Management of Local Agricultural Development: The policy arena in Cuba[1]

Gordon Prain

In the urban setting, agriculture is one strand in a complicated web of activities undertaken by households in pursuit of their livelihoods. As was argued in chapter 10, participatory technology development (PTD) needs to assess the direct impact of innovations on household capitals and potential feedbacks to the urban ecosystem, affecting the capitals of other families. As the livelihoods framework makes clear, these innovations are also filtered through local institutions and policies which are more pervasive and invasive in urban areas than in the countryside. Urban PTD has a better chance of success if agriculture forms part of an integrated approach to urban development, with a supportive and enabling institutional and policy environment.

Marielle Dubbeling

Natural methods for fighting pests are very common in agricultural production in the city of Havana.

A useful example to consider, in which PTD has proceeded within an enabling policy environment, is Cuba. The growth of urban agriculture in Cuba and the uptake of related and innovative technologies have been dramatic and impressive. In just over ten years, between 1989 and 2000, it has moved from a marginal component in urban food systems to an activity covering 12 percent of the land area of the city of Havana, involving a network of more than 22,000 urban and peri-urban producers, providing between 150 to 300 grams of fresh vegetables and culinary herbs daily and has resulted in the near elimination of local refuse dumps for household waste (Cruz and Medina, 2003)[2]. Havana's agriculture involves a range of different systems and technical innovations (Novo and Murphy, 2000), but one of the most interesting from an institutional and policy point of view is "organoponics", an example of institutionalised spatial intensification and bio-intensification in urban areas, supported by the local authority.

The development of organoponics and other organic and urban agricultural technologies are linked to what is known locally as "the special period" which followed the collapse of the Soviet Union and the resultant implosion of the Soviet-dependent Cuban economy (Rosset 2002). At the time of this collapse the Cuban agrarian economy was dominated by large-scale state farms producing sugar cane and other raw materials for export. In 1989, there was three times as much land under sugar cane as food crops and almost 60 percent of the calories consumed by Cubans were from imported food. Production of export crops involved conventional, high input agriculture in which 48 percent of fertilisers and 82 percent of pesticides were imported. The impact of the Soviet collapse was severely aggravated by the continuing blockade which the United States imposed at the time of the Cuban missile crisis in the early sixties. This "vulnerability context" to use the terminology of the livelihoods framework had a direct negative effect on livelihoods. Between 1985 and 1993, calorie intake per person/per day dropped by more than 30 percent to 1863 calories, well below basic nutritional needs. There was also a worsening of new born birth weight, nutritional status of pregnant women and other health repercussions, such as deteriorating public health due to failures in refuse collection.

Innovative livelihoods responses to the crisis occurred at both the level of households and within the political structures. "Patio agriculture" (see chapter 6), household aquaculture, vermiculture and crop-livestock production systems began to flourish and were assisted by local social organisations (eg. Federation of Cuban women and Committees for the Defence of the Revolution) and the emergence of farmers' groups. Institutional changes introduced by the government allowed citizens to become registered as self-employed and to register their businesses. This also involved the hand-over of 2.6 million hectares of land to cooperatives and allowed households and farmer groups to utilise idle land in Havana and other cities for productive purposes. Agricultural markets without price controls were also established. But the apparent key to the fast pace of innovation and transformation of urban agriculture from a marginal occupation to an important component of the national food system was the effort to ensure joint development of innovations by grassroots agencies and the government (Cruz and Medina 2003**)**. An important institutional change to strengthen collaboration was the establishment of People's Councils as a new kind of grassroots government aimed at facilitating the participation of local households in solving problems (Cruz and Medin,a ibid). In terms of livelihoods (see figure 10.1), the "policies, institutions and processes" which households must engage and negotiate with in pursuit of livelihoods strategies were considerably revised to facilitate urban agriculture as a viable livelihoods strategy. This is not to say that reforms of institutions and processes have been perfect. Empowerment of People's Councils to engage in economic relations and develop horizontal linkages with other entities is still incomplete (ibid) and the discourse of urban agriculture, especially in relation to smaller domestic spaces, is by no means fully embraced by Havana urban planners (Premat, 2005).

Kristina Canizares

Organoponics are all over the city of Havana

Organoponic gardens are particular examples of government-community collaboration in technology development and in management. Organoponics involves the construction of raised beds, which are then filled with a nutritious mix of around 50 percent organic matter and 50 percent soil, brought in from other locations, supported by local government (Novo and Murphy, ibid). Both "popular" and "high yield" organoponic gardens have become established, with different types of structures and management arrangements. The technology aims to bring inner city vacant areas which are either paved or have extremely compacted, poor quality soils into productive use. The popular organoponic gardens (POG) involve areas of between 2000 and 5000 square meters with lower investment in raised beds with simpler constructions of holding walls made of tiles, stones or recycled urban materials and filled with a mix of soil and organic matter. The high yield organoponic gardens (HYOG) in contrast involve higher investment in purpose-built structures of asbestos cement on areas generally around 1 hectare, with higher demand for water and requiring larger quantities of organic materials. Establishment and management of the POGs have been based on collaboration between municipal authorities and local neighbourhood groups or groups of workers. The former has supported the supply of inputs and the regularisation of output markets, which are often in the POG itself. The HYOGs involve collaboration between the city government, a state company and local organisations of workers in each individual HYOG. Local HYOGs maintain their own administration and pay a base salary to the members. This is supplemented depending on productivity, which is a strong incentive to innovate. The HYOGs also depend on the city and the state company to organise the supply of financing and material inputs and to support marketing.

On-going technology innovation in these systems has been strongly associated with crop management practices, especially improvements in fertilisation using micro-organisms and biological control methods in integrated pest management (Rosset and Benjamin, 1994; Rosset, 2002). Cuba is a world leader in the production and use of entomopathogens, which are produced in different specialised, low-cost centres (CREEs), distributed through "corner shop" agricultural advice and service centres and widely utilised in the HYOGs, POGs and other types of production systems.

On the other hand, there is notably less innovation in the area of mixed planting and variety experimentation in the HYOGs (Cruz and Medina, 2003). The strong focus of both HYOGs and POGs on vegetable production leads to minimal or zero mixing of different groups of crops (leafy vegetables and root crops, fruit vegetables and aromatic herbs etc). In addition, the existence of specialised seed production facilities (Casas de Posturas) which formalise commercial seed production for the organoponic gardens, may tend to reduce the intra-specific diversity of varieties being grown (Rios personal comm.)

The importance given in Cuba to sustainable crop management practices came from recognition of the country's unsustainable dependence on export-oriented mono-cropping using largely imported inputs. The collapse of these imports in the early 90s – a 60 percent drop in pesticides, a 77 percent drop in fertilisers, petroleum for agriculture down by 50 percent (Altieri et al., 1997) – injected a dramatic urgency into the existing research efforts to develop alternative crop management options, leading to the successful outcomes briefly described above. (see also Chapter 11, this volume). However, the environmental and health benefits of biological and other forms of non-pesticide based pest control for the urban location are becoming recognised more slowly, as is the need for a more holistic view of agriculture within urban space. As Cruz and Medina observe:

> *"The existing design (of urban agriculture) does not favour harmony between the productive space and the constructed space, not only aesthetically…, but also in relation to other components of the urban environment, be they natural, economic or social…Furthermore, the interests of producers and those of the rest of the citizens, not directly associated with the results and impacts of the production activities, should be considered…" (Cruz and Medina, 2003).*

These comments lead us towards the missing element in the Cuban experiment, but an increasingly important component in both North and South thinking about urban planning and the role of agriculture: namely multi-functionality (see Chapter 1 and 7 in this volume). This refers to the opportunity for agriculture in the urban setting to play multiple roles for the urban community, contributing to food security, nutritional well-being, income supplements for low-income families, child and youth education about natural processes and resources and the role of science, family recreation, and to the sustainability of cities.

Notes

[1] Synthesis based on findings of especially Cruz and Medina, 2003 and Novo and Murphy 2000, in addition to the other mentioned sources.

[2] The existence of a recently established alternative agricultural research agenda involving ecological principles, biological control mechanisms etc and linked to government import substitution strategy was also an important factor favouring rapid innovation (Rosset, 2002).

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Resources

Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance.
Jules Pretty, 1995. Earthscan, London.
This book presents a compelling vision of an agriculture that is productive, environmentally sensitive and socially cohesive, and includes a wide range of examples of successful applications of innovative and sustainable practices developed by local communities partnered by research and development organisations. It also describes the kinds of policy environments which can support sustainable agriculture. There are discussions of integrated pest and soil nutrition management, soil conservation techniques and water management which are highly relevant for the urban setting, as is the extended discussion on farmer organisation.

Urban Livelihoods: A people-centred approach to reducing poverty
Edited by Carole Rakodi with Tony Lloyd-Jones, 2002. Earthscan, London.
This is a useful guide to the sustainable livelihoods framework as it can be applied to addressing urban poverty. It does not deal extensively with urban agriculture but includes an important chapter on rural-urban linkages and differences and the role of agriculture along the rural to urban continuum. Important contributions on human and social capital in relation to poverty reduction and on the role of municipalities are included.

Information and Communications Technology: Technology as Potential Catalyst for Sustainable Urban Development - Experiences in Eindhoven, Helsinki, Manchester, Marseilles and The Hague
L van den Berg and W van Winden (eds). 2002. EURICUR Series. Ashgate, UK: European Institute for Comparative Urban Research. 140 pages. ISBN 0 7546 1880 3.
By examining and comparing five European cities, this book sheds light on the impact of ICT on urban development and considers the consequences for urban management. The case studies show how cities use these new technologies to improve the delivery of municipal services, to increase civil participation and local democracy, to help their citizens and businesses make the shift to the information society, but also to fight the potential digital divide.

Environmental problems in an urbanizing world.
Jorge E Hardoy, Diana Mitlin and David Satterthwaite. 2001. London: Earthscan Publications, Ltd. 464 pages. ISBN 1853837 199 (paperback). www.earthscan.co.uk.
This updated and much expanded edition of the classic *Environmental problems in Third World Cities* describes environmental problems and their effect on human health, local ecosystems and global cycles. It points to the political causes that underpin many of these problems – including ineffective, unaccountable governments, and aid agencies' reluctance to work with the urban poor. It also highlights innovative solutions such as high quality, low-cost homes, neighbourhoods developed by poor groups working with NGOs and Local Agenda 21s developed by municipal governments in partnership with community organisations.

Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook. Three-volume Set
Edited by Julian Gonsalves, Thomas Becker, Ann Braun, Dindo Campilan, Hidelisa de Chavez, Elizabeth Fajber, Monica Kapiriri, Joy Rivaca-Caminade, and Ronnie Vernooy.. CIP-UPWARD/IDRC, Los Baños, Philippines.
Research and development can no longer be the exclusive domain of scientists. To find sustainable solutions to development problems, a wider range of actors must be involved. It is crucial, for example, that local stakeholders provide input to the process. Participatory research and development (PR&D) offers such an inclusive model. This three-volume sourcebook provides easy access to field-tested PR&D concepts and practices for practitioners, researchers and academics. It also presents a comprehensive overview of PR&D and will serve as a general reference for trainers, policymakers, donors, and development professionals. The sourcebook captures and examines PR&D experiences from more than 30 countries.

Feeding Cities in Anglophone Africa with Urban Agriculture: Concepts, Tools, and Case Studies for Practitioners, Planners, and Policy Makers
Edited by Marielle Dubbeling, Gordon Prain, Maarten Warnaars and Thomas Zschocke. CD-ROM, Urban *Harvest-CIP, Lima, Peru.*
Also web-based course at http://etraining.cip.cgiar.org.
This CD-ROM presents in interactive and accessible form the contents of an urban agriculture training course for Anglophone African countries conducted in 2004. The content includes a section on the history and concepts of urban agriculture and six modules on: Health Impacts; Crop production systems; Livestock production; Solid waste management; Wastewater use; and Integrating urban agriculture into urban planning and development. The modules can be entered directly, or via their relationship to key "Issues" in urban development, or via actor scenarios or through cities.

Sustainable Communities in Europe
William M Lafferty (ed.). 2001. London (UK): Earthscan Publications Ltd.
This book presents detailed research into the participation and involvement of local communities in 11 European countries. Overviews of implementation in each country are accompanied by comparative analyses of positive and negative changes to date. Useful examples of best practice case studies are provided, and crucial barriers to achieving sustainability are highlighted.

Sustainable agriculture, training of trainers: a resource book
International Institute of Rural Reconstruction (IIRR), 2002. 351 p. ISBN 1 930261 055 US$ 20 (inclusive CD-Rom). Available from: IIRR, Y.C.James Yen Center, Biga, Silang, Cavite, Philippines and ETC EcoCulture, PO Box 64, 3830 AB Leusden, The Netherlands. Email: Bookstore@iirr.org; www.iirr.org
This resource book is designed for trainers in sustainable agriculture. It has been developed as a response to the need to increase the capacity of training institutions in sustainable agriculture to impart and share the concepts, principles and experiences of sustainable agriculture. It brings together IIRR's 40 years of training experience and the results of a five-year Training of Trainers project on sustainable agriculture.

www.cipotato.org/urbanharvest/home.htm
Website of the CGIAR System-wide Initiative **Urban Harvest** on Urban and Peri-urban Agriculture, with updates on technical and policy work in Africa, Asia and Latin America, and links to CGIAR Centres and other urban agriculture websites.

www.prolinnova.net/circular.php
Prolinnova is a NGO-led global programme to promote local innovation in managing natural resources for sustainable agriculture. The site carries information on recent publications, reports, training experiences and materials related to PTD. All issues of the PTD Circular can be found at this site.

www.iirr.org
IIRR is an international NGO, headquartered in the Philippines, which specialises in running training courses on participatory methods, monitoring and evaluation approaches, policy issues etc.

www.livelihoods.org/index.html
Livelihoods Connect is a very useful resource centre for information on different uses of the livelihoods approach, with frequent updates on urban livelihoods issues

www.metrofarm.com
Metrofarm, the on-line magazine of metropolitan agriculture, is mainly focused on the US, with interesting discussions on health risks of commercial fruits and vegetables, profitable agriculture from small urban spaces etc.

www.ids.ac.uk/ids/particip
The Participation, Power and Social Change Team at the Institute of Development Studies (IDS), University of Sussex, UK, serves as a global centre for research, innovation and learning in citizen participation and participatory approaches to development. The website provides an extensive collection of material on issues related to participation such as theory and practice, citizenship and governance, policy, and organisational learning and change.

www.fao.org/participation/default.htm
This is the website of the Informal Working Group on Participatory Approaches and Methods to Support Sustainable Livelihoods & Food Security (IWG-PA) of FAO. The "Resources" part of the website has three sections: library, field tools and lessons learned. The website also supports French, Spanish and Arabic versions.

Chapter 11

Urban Horticulture

Although crops have always been grown inside the city, urban horticulture is expanding and gaining more attention recently. Horticultural products include a large variety of vegetables, cereals, flowers, and trees. Vegetable production provides regular and high incomes to the various actors in the commodity chain and provides food to urban dwellers. Many specific techniques have been developed or adapted specifically for urban areas. If well managed, urban horticulture can play an important role in reducing socio-economic and environmental problems in cities. Urban authorities should collaborate with urban producers to strengthen the role of urban horticulture in waste recycling, community building and creating sustainable food systems.

Urban Horticulture

Philippe Tixier
Hubert de Bon

Introduction

Urban and peri-urban horticulture (UPH) includes all horticultural crops grown for human consumption and ornamental use within and in the immediate surroundings of cities. Although crops have always been grown inside the city, the practice is expanding and gaining more attention. The products of UPH include a large variety of vegetables, cereals, flowers, ornamental trees, aromatic vegetables and mushrooms. Table 11.1 presents the main species cultivated in periurban horticultural systems and more specifically those presented in this chapter. The case study from Yaoundé, Cameroon, later in this chapter, is a good illustration of the large variety of species cultivated in UPH.

Generally, the types of crops cultivated vary according to the area, influenced by culture and tradition. In cities, short-cycle crops are preferred, while in the surroundings of the city crops with longer cycles are cultivated, for example in orchards.

Crops are grown in small gardens or larger fields, using traditional or high-tech and innovative practices. The major production systems and practices of UPH are described in this chapter, together with the major constraints (see also chapter 10). Some new techniques that have been adapted to the urban situation and tackle the main city restrictions are also documented. These include horticultural production on built-up land using various types of substrates (eg. roof top, organic production and hydroponic production), water saving in highly populated areas, the production of pesticide-free vegetables year-round with a low content of heavy metals and human pathogens, and control of wastes and leaching (fertilisers, pesticides, organic matter, water) in the urban environment. Urban and periurban cultivation systems differ from rural systems by their proximity to cities and by the constraints of space, which often lead to greater intensification of production.

Cai Gaojian

The houses and of in-migrants will be much improved if they stay at the place long enough

Through the large variety of crops that are produced, urban horticulture makes a major contribution to food and economic security (see chapter 1 and 6). It also contributes to strengthening social sustainability and increasing ecological sustainability by transforming wastes, conserving natural resources, preventing soil erosion, and reducing pollution. UPH, like UA in general, has multiple functions. The main function is supplying fresh food, but emerging functions that are becoming more and more essential are economic (income generation), social (labour), cultural, living environment (open spaces and greening), environmental (recycling) and security (food and natural risks).

Although most of these species are not specific to periurban horticultural systems and can also be grown elsewhere, horticulture in urban areas minimises the transportation time for the supply of fresh produce to city dwellers. The cropping system in urban and periurban areas is usually adapted to the specific circumstances. Many traditional crops have been adapted to better respond to the needs of city consumers. Horticulture is practised for home-consumption but very often also for the market as high-value cash crops. In such a competitive environment, a focus on profitability may lead to improper management such as the intensive use of water, land and other (chemical) inputs, and thereby pose threats to humans and the environment. This issue will be discussed later in this chapter.

Table 11.1 *Horticultural plants cultivated in urban areas*

Vegetables	**Aromatic and flowering plants**
Amaranth, Genius ***Amaranthus***	Agati, ***Sesbania grandiflora,***
Beans, ***Vigna radiata*** & ***Phaseolus vulgaris***	Basil, ***Ocimum basilicum***
Broccoli, ***Brassica oleracea*** **var.** ***italica***	Chives, ***Allium schoenoprasum***
Cabbage, ***Brassica oleracea*** **var.** ***capitata***	Horseradish tree, ***Armoracia rusticana***
Cassava leaves, ***Manihot esculenta***	Indian borage, ***Plectranthus amboinicus***
Cauliflower, ***Brassica oleracea***	Kohlrabi, ***Brassica oleracea*** **var.** ***gongylodes***
Chinese cabbage, ***Brassica rapa*** **var.** ***pekinensis***	Lemon grass, ***Cymbopogon citratus***
Chinese mustard, ***Brassica juncea*** **var. rugosa**	Mustard, ***Brassica compestris***
Choy sum, ***Brassica rapa*** **var.** ***parachinensis***	Pakchoy, ***Brassica camperstris*** **var** ***chinensis***
Cucumber, ***Cucumis sativus***	Peppers, Genius ***Schinus***
Eggplant, ***Solanum melongena***	Perilla, ***Perilla frutescens***
French bean, ***Phaseolus Aureus***	Roselle, ***Hibiscus sabdariffa***
Garlic, ***Allium sativum***	Tuberose, ***Polianthes tuberosa***
Gourd, Genius ***Cucurbita***	
Indian grass, ***Brassica juncea***	**Fruits**
Indian mustard, ***Brassica juncea***	Banana, Genius ***Musa***
Jaxatu, ***Solanum aethiopicum***	Melon, ***Cucumis melo***
Kangkong (water convolvulus), ***Ipomoea aquatica***	Orange, ***Citrus sinensis***
Leek, ***Allium ampeloprasum***	Papaya, ***Carica papaya***
Lettuce, ***Lactuca sativa***	Peach, ***Prunus persica***
Lotus, ***Nelumbo nucifera***	Pineapple, ***Ananas comosus***
Melindjo***, Gnetum gnemon***	Strawberry, Genius ***Fragaria***
Mungo bean, ***Phaseolus Aureus***	
Okra, ***Hibiscus esculentus***	**Ornemental plants**
Onion, ***Allium cepa***	***Bougainvillea (Genius)***
Palak, ***Beta vulgaris***	***Chrysanthemum (Genius)***
Pea, ***Pisum sativum***	Kumquat, Genius ***Fortunella***
Potato, ***Solanum tuberosum***	Rose, Genius ***Rosa***
Squash, ***Cucurbita maxima***	
Sweet pea, ***Lathyrus odoratus***	
Sweet pepper, ***Capsicum annuum***	
Snow pea, ***Pisum sativum***	
Tomato, ***Lycopersicon esculentum***	
Water morning glory, ***Ipomea aquatica***	
Wheat, ***Triticum aestivum***	
Yardlong bean, ***Vigna unguiculata sesquipedalis***	

Policymakers around the world are showing an increased interest in urban horticulture, although their major focus is still on the temporary use of peri-urban lands. Periurban agriculture is encouraged in poor countries, mainly because it improves food security of poor households and the urban population's nutritional status (freshness of products and better access to fruit and vegetables, considered as a major source of vitamins and micronutrients), especially in view of the inefficient transportation and storage facilities in these countries. Policymakers also encourage UPH because it provides jobs and incomes to poor and landless urban dwellers and because it is well adapted to the urban environment where water and land are scarce.

Urban Demands for Horticulture

The proximity to urban markets often defines the production of specific fruits or vegetables, while there are also seasonal differences between rural and urban areas in terms of supply to the urban market. The case study from Hanoi, Vietnam, is an interesting example of how the horticultural market has evolved dynamically over the years in relation to social, climatic and cultural factors.

Fruits and vegetables for city markets are supplied from different areas: rural, peri-urban and urban, from within the country or from foreign countries. There is complementarity between the supply flows from the various origins, which may change over time. Products from UPH make up a very large part of the supply of vegetables to urban markets, such as in the capital city Hanoi (2.7 million inhabitants). Here, 80 percent of the vegetables (118,628 tonnes), come from the Province of Hanoi, an area of 7,095 ha of urban gardens (Mai Thi Phuong Anh 2000). In Brazzaville, 65 percent of the marketed vegetables come from its urban gardens (Moustier, 1999).

Factors such as climate, soil, access to water, insects and diseases, costs of production and, most importantly, the shelf life of the crop itself, influences the location of vegetable production. The last factor explains why, for most urban markets, leafy vegetables are produced in urban and periurban areas. In Brazzaville, the urban gardens provide 80 percent of the leafy vegetables for the urban market; in Bangui, 100 percent; in Bissau and Antananarivo, 90 percent (Moustier & David, 1997); in Dar-es-Salaam, 90 percent (Sabel-Koschella et al., 1998). Some leafy vegetables are well adapted to a hot wet season. The very short shelf life of cut flowers such as roses and chrysanthemums explains the development of these horticultural crops around Hanoi, where they are grown on 1,000 ha.

The season also influences the distribution of supply to the urban market from rural/ urban areas. In Bangui, the share of tomatoes from rural areas increases from 40 percent to 50 percent in the wet season. In Bissau, the share of tomatoes from urban areas increases from 10 percent to 20 percent in the wet season. Urban horticultural areas may also supply the urban market more regularly than the rural areas. In Nouakchott, UPH supplies the urban market during nine months of the year, whereas the rural areas provide vegetables to the city only during three months (Margiotta 1997). Around Hanoi, choysum and leafy mustard are grown year-round. In Dar-es-Salaam, amaranth is grown throughout the year. This tendency to crop year-round is increased by the UPH producers' need to derive an income from various high-value crops throughout the year. This bias towards UPH may also be due to production constraints and access to transportation infrastructure during the rainy seasons or to socio-economic causes. In some countries, however, where flooding of urban areas expand every year, it is easier to find suitable spaces to grow vegetables in rural areas (Phnom Penh, Dacca).

Even if the consumption of vegetables per person is relatively low, consumer demand remains the major driving force behind UPH. In developing countries, the consumption of vegetables is generally lower than the FAO recommendation of 75 kg/year/inhabitant (205 g/day/capita). The importance of vegetable consumption depends on the population group. Over the period 1994–1998, consumption in Vietnam was higher in urban areas (182 g/capita/day) than in rural areas (122 g/capita/day), but lower than in mountainous areas (196 g/capita/day) (Nguyen Thi Lam & Ha Huy Khoi 1999). As is shown in Table 11.2, the consumption of vegetables in Bangladesh was higher in urban areas than in rural areas (Ali 2000).

Table 11.2 *Monthly per capita consumption of vegetables (kg) in Bangladesh*

Household	Total vegetables	Leafy vegetables	Potato	Banana, papaya & eggplant	Other vegetables
Rural	6.20	1.42	1.67	0.82	2.29
Urban	5.13	1.08	1.13	0.80	2.12

Source: Ali (2000).

Urban consumption is related to the size of households, income and socio-cultural characteristics (Bicas 1998). In Africa, the most popular vegetables are tomato, onion and leafy vegetables, but there are location-specific variations. In Brazzaville, for instance, the importance of vegetables varies from one socio-economic group to another (Moustier, 1999).

Culture and festivals also have a very strong influence on consumer demand for specific products. In many countries, the main demand for flowers occurs on Mother's Day, Valentine's Day and during the Christmas period. In Vietnam, the Tet celebration is the opportunity to offer two ornamental trees: kumquats bearing mature orange fruits and peach trees in blossom. In urban and periurban areas in Hanoi, ornamental fruit-tree specialists have set up production to meet this demand, which means that they nurture young trees for a period of one year to prepare them for sale.

Table 11.3 *Most frequently eaten vegetables per socio-economic group in Brazzaville (Congo) (ranked in order of importance)*

Socio-economic group	Vegetables eaten most frequently
Congolese households	Cassava leaves, cherry tomato, pakchoy, roselle, melinjo, dry kidney bean
Non-Congolese African households	Potato, cassava leaves, cherry tomato, dry kidney bean, amaranth, lettuce
Expatriates	Potato, "European-type" vegetables

Source: Moustier (1999).

Factors Influencing Urban Horticulture

The development of horticultural systems in urban and peri-urban areas is determined by specific opportunities and constraints in the city. The constraints are mainly related to resource scarcity (water, land, labour and access to other inputs) and pollution.

Access to natural resources and labour

Access to suitable land is a key factor in urban agricultural development. Land ownership and tenure arrangements are important (see also chapter 3). In the large and fast-growing cities of developing countries, land pressure is great and often leads to rising prices. In this context, access to land by urban or periurban producers is difficult and poses a major constraint to their activities. As they are usually not landowners, they are obliged to rent from others or to squat on public land in order to have a small plot to cultivate. This uncertainty of land tenure has a strong influence on land-use strategy and maintenance. Producers may select fast-growing plants (such as leafy vegetables) rather than perennials (such as fruit trees); and may use places regarded as unsuitable for dwellings (such as swamps), which limits the range of crops that can be grown.

Insecurity of land tenure is a major problem that often leads to two types of responses by producers, who do not always take the long-term effects of agricultural practices into account. As a result they might choose inputs with strong and quick effects, such as chemical fertilisers and pesticides, rather than improving the soil using long-acting fertilisers and integrated production techniques. Producers may even turn to soil-less production systems on diverse substrata.


Cai Gaojian

Looking after the greenhouse and picking cucumbers.

The size of plots is also a constraint. In the inner cities or periurban areas, horticultural crops are grown on very small parcels of land. This leads to the development of specific systems: intensive, high-yielding and year-round with the same or different crops. High yields require high use of inputs – water and fertiliser – combined with good light. The role of substrates to grow the crops is essential. As will be discussed later, different techniques have been developed for cases of little land or poor soil quality, such as hydroponics or organoponics.

Different sources of water are available in urban and periurban areas: potable water, wastewater, rivers, lakes and ponds. The specificity of horticultural systems is their adaptability in using these different sources, particularly the use of wastewater (see chapter 9). In all cases, this scarce source needs to be used efficiently and with precaution. Drip irrigation with different systems of micro-irrigation is possible. Use of a watering tank is more popular and is also one of the most efficient systems. The advantage of wastewater is that it provides nutrients together with the water. This saves the cost of fertilisers and labour to apply the fertiliser.

In urban areas, there is fierce competition for the use of land and water between horticultural activities and other economic activities. In a context of high economical competition, horticulture can be maintained if it generates more benefits than any other use of the resources (see also chapters 6 and 7 on this). Yet, even without intensification of production and even if it is less profitable, horticulture continues to exist, if its other functions (i.e. cultural) are valued by city stakeholders.

Another aspect of this competition comes from the many other human economic activities that occupy urban producers. In Hanoi, for instance, periurban gardeners seek jobs in industry, business and administration. Most often urban horticulture is a part-time job in this city, and different activities are combined in order to maintain livelihoods. The household members also divide their activities between production, sales and employment. The multiple economic activities of most urban gardeners may lead to a lack of sufficient labour during certain cropping periods such as planting or harvesting or for irrigation. The urban economy and its dynamics assign different responsibilities to women and men: women are often more involved in the cultivation and marketing (West Africa) activities than in rural and traditional horticultural systems.

Environmental pollution

Industry, services, traffic and high population density in urban areas are known to cause pollution to water, soil and air and reduce light intensity. A major challenge for urban agriculture, and especially for horticulture, is to supply safe products in this often polluted environment. In urban or periurban areas, the main pollutants of horticultural crops are heavy metals, pesticide residues, and biological contaminants. Such pollution presents a risk not only to the consumers, but also to the producers who come in contact with contaminated materials, for instance in wastewater. Additionally, these forms of pollution can be major factors in limiting crop growth. The problems occur mainly in areas close to active or old industrial sites, on urban waste disposal sites, when irrigating is done with water that contains heavy metals, fertilisers or organic matter, or when contaminated soils are used for cultivation. The source of human parasites are wastewater or animal wastes that are not composted (see chapter 8-9).

Heavy metals

The main causes of soil pollution from heavy metals (including lead, cadmium, chromium, zinc, copper, nickel, mercury, manganese, selenium and arsenic) are irrigation with water from streams and wastewater contaminated by industry, the application of contaminated solid wastes and the use of former industrial land contaminated by spilled oil and industrial wastes. Toxicity from heavy metals can directly affect plant physiology and growth and many cases of toxicity from heavy metals have been reported. For example, Jørgensen et al., 2005 show that intensive horticultural systems (particularly in greenhouses) in urban areas may be threatened by soil toxicity through trace elements such as Zn, Cu, As and Pb. The soils in many cities in developing countries have very high heavy metal contents. If the concentration of these elements in human food increases, it may cause toxic symptoms and cause damage to health (carcinogenic and mutagenic effects).

Mario Gonzalez Novo

Organoponics in Cuba

The health effects and the heavy metal threshold concentration under which it is possible to practise safe agriculture have been subjects of much discussion. Puschenreiter et al., 1999 conclude that, having considered the several available pathways to reduce the transfer of heavy metals to the human food chain, urban soils with slight contamination by heavy metals can be used safely for gardening and agriculture if proper precautions are taken. However, Birley and Lock (2000) argue that little is known of the chronic health effects of consuming tiny amounts of heavy metals over long periods of time and that further research is needed. Mapanda et al., (2005) show that, in vegetable gardens of Harare (Zimbabwe), irrigation by wastewater may lead to significant heavy metal (Cu, Zn, Cd, Ni, Cr and Pb) enrichment in the soils. On the other hand, studies have shown that production in urban and periurban areas does not produce lower-quality vegetables than in rural areas (Midmore, 1998). Depending on the species and the plant parts, accumulation of heavy metals varies. Leaves can reach a high level while seeds are often less affected. It is possible to adapt the choice of crops in relation to the degree and type of contamination. Some horticultural crops such as beans, peas, melons, tomatoes and peppers show very low uptake of heavy metals.

The risk of pollution depends directly on the location of the fields. The rate of absorption of heavy metals by vegetables seems to be linked with their levels in the soil. Lead is taken up by the plant roots and is then transported to the leaves. Lead from traffic fumes in the air settles on the leaves. It can be washed away by watering the leaves, especially when the leaf surface is waxy (cruciferous plants, Alliums). Cadmium can be taken up by plants through roots and leaves. For these two very poisonous heavy metals with no positive biological functions, their presence in plants is controlled by respecting the soil standards. The location of vegetable production, with regard to roads and polluting industries, should be selected carefully. Bio-remediation of the soil by plants and installation of mycorrizae limiting heavy metal uptake are long-term projects that might help in management of heavy metals in the future.

In addition to heavy metals, air pollution too can contribute to crop toxicity. For instance, Agrawal *et al*. (2003) show that, in the polluted environment of Varnasi, India, some physiological characteristics of bean, palak, wheat and mustard are significantly affected by the SO_2, NO_2 and O_3 O3 concentration, which are very common. These gases are very common in large cities in developing countries, especially with the fast growth of personal transport.

Pesticide residues and fertilisers

As in many forms of crop production, horticulture is confronted with pesticide residues in the plants and pesticide exportation to the environment. This can lead to major health problems for producers and/or consumers. The residues of pesticides and fertilisers originate not only from agricultural inputs used by the producers. Cultivation in contaminated areas or irrigation with contaminated wastewater, also contribute to increasing the residual levels in plants above the allowed limit.

These contaminants are absorbed on soil and are characterised by a very long half-life. Most belong to families of products that are banned worldwide. The crops containing these pesticide residues are mostly tubers and root vegetables. For instance, in the periurban cropping system in the French West Indies (more specifically home-gardens), root vegetables (manioc, yam) grown on plots where organo-chlorine has been used, even many years ago, contain some residues and may constitute a risk to consumers' health. In this case the risk is further enhanced due to the improper management of land.

Biological contaminants

The contamination of crops with pathogenic organisms by re-use of urban wastewater and organic solid wastes is an important issue associated with food safety, especially in the context of UPH (see chapter 8-9). These diseases may affect the producers who handle the contaminated material, as well as the consumers who may eat contaminated fruits or vegetables.

In horticultural systems, solid wastes are mainly used to improve the soil (household wastes, market refuse, sewerage, night soil, manure, fish wastes and agro-industrial wastes). Urban organic wastes are mainly composted; this process significantly reduces health risks.

If the compost is not properly prepared (at a too low temperature), the organic wastes can still contain pathogens (bacteria, helminth eggs, etc). The risk is greatly enhanced if organic materials are mixed with human excreta from latrines, manure or hospital waste, causing pathogens to breed. The use of domestic sewage for irrigating and fertilising field crops, perennials and trees is widespread. A large part of the wastewater used is untreated or poorly treated and contains various bacteria, protozoan parasites, enteric viruses and helminths. Coliform bacteria are mainly transmitted to humans from wastewater via the contamination of crops irrigated with wastewater or through consumption of contaminated meat from domestic animals that have ingested tapeworm eggs from faeces in untreated sewage.

Pollution by horticultural practices

Horticultural systems may also pose a risk to their environments, and especially so in an urban context because of the proximity to people. Additional conflicts may arise between urban gardeners and city dwellers, especially when horticultural systems cause odours or, improperly, use large amounts of pesticides or fertilisers – artificial or otherwise – that urban dwellers fear may cause pollution. Although it is a general rule that inputs that affect human and environmental health must be used with care, this is more so in urban areas. The intensive use of agrochemicals (fertilisers, pesticides, fungicides) may lead to residues in crops, surface water or groundwater and cause negative effects to the health of agricultural workers.

Pesticides

All levels of cropping intensity are encountered in urban areas, from the most extensive (traditional) in developing countries and in allotment gardens, to the very intensive agriculture using high amounts of agrochemicals. Logically, the levels of pollution risk vary depending on the intensity of production.

Vegetables containing pesticide residues above the maximum residue limit have been identified in markets (Moustier 2000, Midmore 1998, Fatou Diop Gueye & Sy, 2001). In Accra, for example, a survey in 1998 of common cabbages collected from the retail market showed high residues of methamidophos, with two out of 20 samples exceeding the maximum residue limit (Sonou 2001). This occurs often, in spite of the fact that regulations for the use of pesticides and recommendations for health safety are in place. The application of pesticides on crops also endangers workers if little information is available on how to use them and when no protective measures are taken. This mainly affects low-income gardeners who cannot afford to buy proper protective clothing and equipment or are not aware of the importance of doing so.

Awareness of the risks caused by excessive use of chemical pesticides exists among all stakeholders, ranging from producers, consumers and public authorities to agrochemical companies. The UPH sector is more sensitive to this problem because of the proximity of consumer and producer. At this point in time, the penalties are not high enough to drastically reduce the over-use of pesticides. More negotiation between all players in the commodity chain might be one solution. In any case, there will be a cost, implying that the consumer must be ready to pay more to have a better-quality product and a safer environment. The development of new technologies such as integrated pest management and biological control can help in reducing pesticide use.

Nitrates

Nitrates deserve mention in pollution related to agriculture inputs. They can cause health problems to young children and pregnant women. Nitrates are also an indicator of good or bad agricultural practices. Nitrates cause eutrophication of water in combination with phosphorus. In Europe there are standards regulating the nitrate content in crops and water. In UPH systems, nitrates stem from fertilisation and from irrigation water. Some quick tests, such as Nitracheck®, appear to help producers manage nitrogen. Still, many of the methods available need to be validated for the specific urban and periurban leafy vegetables grown in developing countries. Moreover, with the aim of making better use of organic matter obtained from urban wastes in mind, specific tools need to be developed that take into account the problem of the irregular and slow release of nitrogen. If the source of pollution is close to the water resource, as is often the case with UPH, the risk of pollution of water by nitrates is enhanced. This is particularly true in developing countries that do not have a good network of water supply and where many people depend on the local water resources for their supply.

Recommendations for safe urban horticulture

De Zeeuw and Lock (2000) suggest a number of prevention and control measures that can be applied in UPH systems to help produce safe and healthy products. Such measures should help reduce risk of pollution of crops by heavy metals, agrochemical residues, pathogens and diseases. The general principle of these 'good practices' is often based on good communication between health sector actors and urban farmers, ensuring the latter is educated to respect rules to limit/ stop contamination of the horticultural products. A summary of the major recommendations is presented below (see Box 11.1).

Box 11.1 *Major recommendations to reduce risks (see also chapters 8 and 9)*

Heavy metals

- Define norms regarding crop restrictions according to type and level of contamination of agricultural soils; test agricultural soils and irrigation water for heavy metals;
- Establish minimum distance between fields and main roads and/or boundary crops to be planted beside them;
- Treat soil to immobilise heavy metals: application of lime increases pH and thus decreases the availability of metals, except for selenium; application of farmyard manure reduces the heavy metal content of nickel, zinc and copper (but may increase cadmium levels); iron oxides (like red mud) and zeolites are also known to absorb heavy metals such as cadmium and arsenic;
- Wash and process contaminated crops to effectively reduce heavy metal content;
- Use plants such as Indian grass for biological remediation of polluted soils or streams (when planted in hydroponic beds).

Agrochemical residues

- Train of gardeners in proper management of agrochemicals;
- Promote ecological farming practices and replacement of chemical control of pests and diseases by integrated pest and disease management techniques;
- Establish better control on sales of banned pesticides;
- Introduce cheap protective clothing and equipment;
- Monitor residues of agrochemicals in groundwater.

Irrigation

- Improve inter-sectoral linkages between health, agriculture, waste and environmental management;
- Separate waste at source; collect organic refuse regularly;
- Establish decentralised composting sites; ensure the application of proper composting methods (temperature, duration) to kill pathogens;
- Identify quality standards for municipal waste streams and composts produced from them; monitor quality of soils, irrigation water from rivers and wastewater outlets, and composts; certify safe production areas; restrict of crop choice in areas where wastewater is used but water quality cannot be guaranteed;
- Establish adequate wastewater-treatment facilities with appropriate technologies;
- Train gardeners in managing health risks (for workers and consumers) associated with re-use of waste in agriculture;
- Educate consumers (scraping and washing of fresh salads; eating only well-cooked food).

Diseases

- Maintain cooperation between the health sector and the natural resource management sector (solid waste management, water storage, sewerage, agriculture and irrigation);
- Ensure water tanks and irrigation systems (especially in periurban areas) properly designed to prevent malaria;
- Apply slow-release floating formulations to control the malarial vector; use expanded polystyrene balls to effectively control mosquito breeding in latrines and stagnant polluted water.

Agronomic Techniques

Horticulture in urban areas will continue to be adapted to specific circumstances, as determined by the opportunities and constraints, and specific techniques will be developed, including combinations of practices from traditional horticulture and more modern, innovative practices.

Horticulture is practised in various agro-ecological and climatic zones, from dry areas to tropical and equatorial climates, in areas with cold seasons and in those without. Urban producers strive to grow crops year-round, to be able to better regulate delivery. However, in different parts of the world, certain periods of the year are too cold or too hot to produce crops. Or the producer faces drought in arid zones and excess of water in wet tropical areas, mainly in the rainy season. Temperatures can be regulated by using greenhouses and plastic covers. In developed countries, vegetables are grown in greenhouses with a cooling system to decrease air temperature. In developing countries, the two main difficulties faced are excess of water or lack of water.

Gabriel Ramirez Garcia

Productive Micro Farm in San Luis Huexotla

In tropical areas, the distribution of rainfall often varies greatly between the dry season, which is usually colder, and the wet season, which is usually warmer. In the wet season, heavy rains may stop horticultural activities even though the consumer demand is high. In solving this problem, producers in some areas, such as Martinique (French West Indies) and Mayotte, use shelters as "umbrellas" to prevent an excess of water for the crops. In some areas, despite the tropical location (eg. Réunion or Vietnam), heated shelters have to be used during winter when the temperatures are low. In some other cases, an insect-proof greenhouse has to be used to protect the crops (at least in its early stage of growth) from a virus frequently transmitted by insects. This is the case of tomatoes which can be infected by PYMV (Potato Yellow Mosaic Virus) and TYLCV (Tomato Yellow Leaf Curl Virus) through the white fly (*Bemisia tabaci*). These shelters help increase yields but require significant investment and may lead to side effects, such as the soil becoming too poor to further sustain production. Producers may need to turn to new techniques as described in the next section (organoponics or hydroponics). Producers, whether rural or urban, are always willing to adapt and improve their practices based on their own experiences and new information. Most of the new techniques however require access to capital for investments and access to specific knowledge.

Irrigation systems

Water is essential for the growth of plants. Water requirements are related to climatic conditions and plant species. In most capital cities of developing countries located in tropical and subtropical areas, the quantities needed vary from 0,1 to 1 l / m^2/day in very dry and hot weather. For a crop of 30 days, the quantity of water needed by a leafy vegetable during the dry season is around 15 l/m^2. The case study of Dakar, Senegal emphasises the issue of water management in a context of limited availability.

Generally, water availability in cities has been showing a decreasing trend and the forecasts predict it will continue at least in the next 30 years (see chapter 9). Water is a necessity for crop production. Depending on the climate and the yields, producing 1 kg of a crop such as tomato requires 60–140 litres of water. Table 11.4 presents the approximate rates of water consumption of some horticultural crops.

Table 11.4 *Water consumption of some horticultural crops*

Vegetables	Cycle length (without nursery) days	Yield kg/m^2	Waters need $litre/m^2$ (tropical)
Tomato	120	6	400 – 800
Non-leafy Chinese cabbage	40	2	150- 300

Different techniques are used for irrigation. Water is applied by overhead irrigation using watering cans, and also through sprinklers or perforated pipes from wells, ponds or the sewer.

Vegetables, especially leafy ones such as lettuce and cabbage, need to be watered twice a day, every day or at least every other day to obtain a good quality (freshness, tenderness) for marketing. There are two steps in watering: 1) lifting the water or bringing it to the plots, and 2) applying the water to the plants. These two steps may be merged or kept separate. For UPH in developing countries, the watering can is the most commonly used system. Each can holds 8–15 litres; one worker usually carries two cans. The water is taken from shallow wells, deep wells, "céanes" in Senegal (which are wells fed by groundwater and often located at the bottom of slopes and strongly polluted by nitrates), small cement reservoirs, drums (Ghana) etc. Reservoirs are filled by hand using small buckets, or with treadle, electric or motorised pumps. In Vietnam, people irrigate by submersing the crop or by using small hand buckets to lift water from canals to fields. The manual system is efficient because, most of the time, the gardener applies exactly the quantity of water needed by the crop. It is labour intensive, and in Senegal, this operation takes 60 percent of the total labour requirement for vegetable production.

Drip or trickle irrigation is another irrigation technique that has been promoted for nearly twenty years. It saves water by 10–20 percent compared to overhead irrigation, but requires clean water in order to avoid blocking of the emitters. The fully-fledged system includes filters, pumps and a pressure regulator, which low-income vegetable growers cannot usually afford. The advantage of this technique is that water is not in contact with the fruits and leaves. It will not, however, avoid contamination of the soil and roots of vegetables with biological pathogens. Underground irrigation provides water to the plant by capillary action. Such an underground system can limit the transmission of pathogens to the vegetables thanks to the filtrating effect of the soil. But installation (flat soil) and operation (control of the flow to the plants) are rather difficult. Some simple drip-irrigation systems have been developed, e.g. in South Africa. This system consists of a 210-litre drum, which is connected via a tap to a set of five polyethylene dripper lines, each with a length of 6 m. The drippers are constructed by perforating the polyethylene pipe with a heated nail. A piece of string is threaded through these perforations by means of a bag-needle. Knots on both ends of the string prevent it from slipping out of the pipe. When the perforations get clogged, pulling the string from side to side usually unblocks the openings. Clogging of the drippers is reduced by placing a stone and sand filter at the bottom of the drum. The filter prevents coarse particles, which may be present in the irrigation water, from entering the pipes and blocking the drippers (Khosa et al. 2003). Such a system of micro-irrigation is particularly suitable for small farms in urban areas, because it does not need a high capital investment and because it uses rainwater collected from roofs.

Fertilisation

Crops require nutrients: macro-elements such as nitrogen, phosphorus, potassium, calcium and potassium; and micro-elements such as manganese, copper etc. Intensive cropping systems on very small areas, using only solid and liquid urban wastes, are not always optimal for crops.

Two main groups of fertilisers are used: organic fertilisers and chemical (or inorganic) fertilisers. There has always been a heavy use of organic fertilisers in intensive production such as vegetables and ornamental flowers. The quantity varies from a few tons/ha to 50 or even 100 tons per year. Organic fertilisers provide most of the micro-nutrients and in addition improve the structure of the soil. Organic fertilisers can be manure from livestock or poultry, compost from vegetable wastes or wastes from urban activities: sewage sludge, night soils, household wastes etc. Over many centuries, periurban and urban farmers have managed and recycled urban wastes (Fleury and Moustier 1999). In South-East Asia, use of fresh night soil is a common practice even though it disseminates human pathogens. These practices may cause some risks to the environment – pollution of soils with heavy metals from sewage sludge, pollution of water with nitrates due to large quantities of organic manure – and also to the health of the consumer.

Robert J. Holmer

Bucket Drip Irrigation in Philippines

Solid organic fertilisers have the disadvantage that they release nutrients, especially nitrogen, slowly. Liquid fertilisers act more quickly. This explains why liquid organic fertilisers are often used on short-cycle leafy vegetables like amaranth and mustard. In Hanoi (Vietnam), liquid organic fertiliser, eg. pig urine, is used to supply nitrogen during crop growth. Research has often focused combining organic and inorganic fertilisers to enhance their efficacy. AVRDC (World Vegetable Center) is working on producing an organic liquid fertiliser that does not endanger consumer health (AVRDC, 2000). The use of organic wastes as fertiliser can lead to different forms of pollution as discussed earlier. This problem is strongly linked to recycling in the cities (see chapter 8).

Inorganic fertilisers are easier to use and allow for application of the right dose of nutrients. However, there are risks of over-application and contamination of soils and water by nitrates and phosphates, which is especially relevant in the city. Also, they could be a source of heavy metals. In Thailand, it has been shown that ammonium phosphate can release cadmium, zinc and chrome into the environment in excessive quantities (Tran Khac Thi, 1999). Urea is the main inorganic fertiliser used in horticulture, especially for vegetables. There is often a lack of phosphorus and potash, and this can lead to an imbalance in the proportion of nutrients in the soil. However, the access to fertilisers in general and inorganic fertilisers in particular still requires a fairly high investment by farmers in most developing countries.

Pesticides

Chemical pesticides have contributed to yield increases in agriculture in general for more than 50 years. Especially in periurban horticulture, easy access to pesticides (via national and international companies, retailers and wholesalers) and technical information has increased its use. However, this has also increased the negative perception of agricultural production in and around the cities. There are three major risks involved: i) health risks for consumers; ii) risks of polluting the environment (mainly water sources); and iii) risks for users. Surveys have been conducted regularly on the use of chemicals, their rate of application and the period between the last application and the harvest for marketing.

In Vietnam, low-cost pesticides (organo-phosphates, pyrethroids, carbamates) with high toxicity (classes I and II) are very commonly used with little information about how to use them. Surveys shows that application rates are much higher than the recommended rates for most of the pesticides used. This and the high spraying frequency are the causes for high pesticide residues in the marketed vegetables.

Pesticides in the city's surface and waste water does not necessary come from urban horticultural production. Still when this water is used for urban crop irrigation, it constitutes a high risk. In Bangkok, a survey has shown residues of organo-chlorine and organo-phosphate in irrigation water (Eiumnoh & Parkpian 1998).

Urban Horticultural Systems

Rural horticulture adapted to urban situations

Kessler (2003) describes the different farming systems in four West African capitals (Lome, Cotonou, Bamako and Ouagadougou). In this study, the farming systems are characterised by the crops grown by farmers. The study reveals that differences in crops and inputs of the different farming systems are due to different economic strategies adopted by the farmers. Mixed vegetable farming with watering cans and/or with pumps to cultivate short- and long-cycle vegetables like lettuce, cabbage, carrots, onions, etc. is an example.

Similar systems are also described in Asia. Farming systems in the peri-urban areas of Hubli-Dharward (India) comprise vegetable production, agroforestry systems, Napier grass (fodder) production and small-scale livestock production (Bradford et al., 2002). In Hyderabad (India), the predominant system is paragrass production, which like Napier grass is used as folder. Green leafy vegetables are grown here on small sections for subsistence needs and for sale. Other crops include rice, fruit trees and flowers. There is also coconut and banana as well as livestock (water buffalo) keeping (Buechler et al., 2002). In Cagayan de Oro (Philippines), urban types of agriculture are characterised by home gardens as well as aquaculture and other specialised food crops (banana, cereals, vegetables etc.,usually as mono-crops). Production can be for home consumption as well as for market sale. Peri-urban agriculture is often dominated by irrigated vegetable production, as is the case in Vietnam or Malaysia. Other systems that can be counted are commercial and domestic livestock production, flowers and seldom agroforestry (Potutan et al., 2000; own observations). Major systems mentioned for Shanghai are cereals, vegetable and livestock production (Yi-Zhang and Zhangen, 2000).

F. Arroyo

Organoponics in small buckets

Many additional types could be named using the major crops grown or animals raised as a criterion. A study under the Urban Harvest Programme (www.cipotato.org/urbanharvest/home.htm) in Cameroon identified three major types of cropping systems:

1. mixed crop systems dominated by open-pollinated varieties (OPVs) of improved maize in the upland areas (vacant lots, unused municipal lands);
2. mono-cropping systems of OPVs of improved maize grown in valley bottoms; and

3. intensive horticultural systems in valley bottoms, primarily for the production of traditional leafy vegetables (TLVs).

In addition, they observed that there is widespread use of small home garden plots for growing leafy vegetables and stands of banana, plantain, avocado, African plum and other fruit trees around homesteads. Within these cropping systems, the research identified two types of agricultural units: "commercial" and "household food" producers based on the criterion of producing for sale, at least, half of the output from one of their products. The study found that women are the main producers for both household food and for sale, accounting for 87 percent of the total sample (see also the case of Yaounde).

Moustier in chapter 7 summarises the different descriptions found in literature of cropping and farming systems in 5 major types of urban agriculture:

- Subsistence home intra-urban farmers (intra-urban and peri-urban areas)
- Family-type commercial farmers (intra-urban and peri-urban areas)
- Urban and peri-urban agricultural entrepreneurs (intra-urban and peri-urban areas)
- Multi-cropping peri-urban farmers (peri-urban areas)
- Urban residents with speculative strategies (intra-urban and peri-urban areas)

Although quantitative data on the importance of each of these types are scarce, available figures for West and Central Africa suggest the dominance of family commercial farmers in terms of number and of importance in urban food supply (Moustier, in chapter 7). In Dakar, out of 5025 urban farmers, 70 percent were family commercial farmers, 25 percent were entrepreneurs and 5 percent were subsistence farmers (Mbaye and Moustier, 2000). Households may move from one category to another, for instance when products are being sold in the market. The (semi) commercial households' main aim is to have a regular income and a regular food supply for securing their livelihoods. Therefore the cropping system is based on crops that add high value and that are less risky to grow on small parcels of land. Leafy vegetables with short cropping cycles that enable regular cash generation are a typical example.

New Urban Horticultural Systems

New horticultural practices have been developed to maximise the use of space, to optimise the use of inputs and to minimise impacts of horticulture on human and environmental health. Some of the new techniques described here are: growing horticultural crops on urban built-up land with various types of urban substrates (eg. on roof tops, organic farming and hydroponic production), to save water in highly populated areas, to produce pesticide-free vegetables year-round with a low content of heavy metals and human pathogens, and to control wastage and leaching (fertilisers, pesticides, organic matter, water) into the urban environment.

These techniques take into account the specific constraints of UPH systems, but are more demanding than traditional or conventional techniques in terms of new knowledge and/or investments.

Hydroponics

Hydroponics is a technology characterised by the absence of soil. It needs less space, labour, external inputs and time, but needs proper management and often higher investments. As mentioned earlier, it is often difficult to control or quantify nutrient availability in the soil. Hydroponic systems provide a convenient means to control plant uptake of nutrients. An additional advantage of water culture is its secondary effects such as accumulation of soil toxins are likely to be reduced (Lissner et al., 2003). Another advantage of growing without soil is that it reduces some soil-borne diseases.

The basic concept of hydroponics is that roots suspended in moving water absorb food and oxygen rapidly. Of special concern is the availability of oxygen. The grower's task is to balance the combination of water, nutrients and oxygen with the plants' needs in order to maximise yield and quality. The use of water and inputs is optimised: the exact amount needed by the plants is provided. For the best results, a few important parameters need to be taken into account: temperature, humidity and CO_2 levels, light intensity, ventilation and the plant's genetic make-up. In order to fix the crop roots in the required position, some inert substrata may be used (sponges, artificial mineral marbles, rock wool etc).

Water quantity and quality are key factors in hydroponic systems. Water quality depends mainly on the source used. Growers use water from different sources, such as surface water (lakes, natural and artificial ponds), groundwater (wells), municipal tap water, rainwater and combinations of these. Rainwater has a low ionic strength and usually low micro-organism and algal densities; it conforms to water quality guidelines and is often better than other sources. A common practice is to collect rainwater from greenhouse roofs into ponds. However, as these ponds are fed by atmospheric precipitation, they are vulnerable to changes in the environment, eg. eutrophication and acidification. Rainwater is not always available for use in irrigation because of technical problems in collection and storage. Therefore, the grower must find other water sources, eg. rivers or lakes, but, in many cases, such sources are polluted (Schwarz et al., 2005).

Hydroponics allows production in abundance of healthy fresh vegetables, ornamentals, aromatic and medicinal plants and suits the requirements of poor urban farmers. When the technique is well controlled, the productivity generated by hydroponic systems is greater than that from traditional gardening systems. It is a perfect technology for urban or periurban areas where the soil is poor or polluted. In many countries of South America, hydroponics is a technique that is fast gaining importance (Tabares, 2003; Rios, 2003).

Small hydroponic units can be operated by families. This may help in meeting their food needs and in getting an additional income. Some special hydroponic techniques have been developed, especially for limited spaces and to suit people in developing countries. Such simplified hydroponic systems often use recycled materials and are easier to understand, learn and implement (Caldeyro-Stajano 2004). Simplified hydroponics is a technology incorporating soil-less culture techniques without using mechanical devices or testing equipment. This technology was developed in the early 1980s in Colombia and is propagated by FAO. It is accessible to people with limited resources and is optimised to use minimal inputs of land space, water, nutrients and grower infrastructure (See Box 11.2). A Family Economical Unit (FEU) of 20 bed-growers of 2 m^2 each (40 m^2) is designed to produce crops that bring an income estimated at USD 3.33 per day in Colombia (year 2000 figures). Simplified hydroponics is well suited to fresh vegetables and fruits (with a high water content) such as lettuces, tomato, bell pepper, basil, celery and radish.

Box 11.2 *Cost estimation of a simplified hydroponic system*

In data gathered from the Colombia project, the results of garden productivity were averaged and the commercial values were estimated. The cost of building 20 bed-growers for the FEU from recycled wood is estimated to be USD 12.84 (6.42 m^2). The annual costs for operating a garden, using the same crops as in the Colombia project, will average about USD 355. This includes costs for medium replacement, seeds, nutrients and water. The annual net income from this garden is estimated to be about USD 1210.00 (USD 101/month). Water is applied to the bed-growers and the excess water is collected underneath them and recycled to the growers the next day. The average water use for a grower is 2–4 litres/day/m^2 or at most 160 litres per day. The annual water requirement for each garden is estimated to be 60,000–120,000 litres.

Another interesting process is hydroponics with floaters, where plants are fixed on polystyrene beds that float over a tank. The water surface is completely covered by the floating bed which permits a very limited growth of algae. The tank's nutritive solution is oxygenated, eg. by a pump. This hydroponic system is characterised by a large volume of nutritive solution, no losses of water, minimal evaporation and the possibility to use the solution for many crop cycles. It is a low-cost method needing little maintenance. It is used in Martinique (French West Indies), an island with high constraints of space in periurban areas, for production of lettuce or onion (Langlais, CIRAD, pers. comm.). Hydroponic systems also present interesting solutions in combination with the recycling of water, and has been studied in water hyacinth, reed and flower (roses) production systems. Another possible future development of hydroponics is the production of bio-energy crops using wastewater as a nutrient solution (Mavrogianopoulos et al., 2002).

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A large variety of crops can be grown on a small area

The use of wastewater in hydroponic systems requires monitoring of the water quality. The Gravel Bed Hydroponic system (GBH) developed by the University of Portsmouth, UK, includes a rock filter in gabions for primary treatment, GBH beds for secondary treatment and a pond for tertiary treatment. It reduced the biochemical oxygen demand (from 350 to less than 20 mg/l) of the output water in a bed planted with narrowleaf cattail (*Typha angustifolia)* in Colombia (Stott et al., 1999). Williams et al., 1999 also show that the use of GBH in Egypt permitted a significant removal of parasite eggs from domestic wastewater.

Organoponics

Organoponic systems grow crops on organic substrata to replace unavailable chemical inputs. The crops are sown in holes or furrows filled with an organic substratum, the concentration allows maximisation of its effect. The origin of the substratum can be diverse, including compost or organic residues from other sources (faeces, wastewater residues etc). The technique is widely used in Cuba and Venezuela.

Organoponics is particularly suited to soils of very low fertility; in the long term, it helps restore the soils by increasing the soil organic matter content. It is also well suited for vegetable production in urban and periurban areas because it maximises the use of space and water. However, in an urban context, the supply of organic substrata can be limited. Depending on the origin of the substratum, some pollution and sanitation problems may be increased, especially when solid waste compost that could contain heavy metals is used. Linking horticultural organoponic systems with ecological sanitation (as described in the Urban Agriculture Magazine no.10) or use of manure, could increase the productivity of organoponic systems.

Green buildings

In developed countries, covering buildings with plants (green building strategy) is part of the ecological design of urban landscapes and is becoming increasingly widespread (Calkins 2004). To be a nutrient capture system, to recycle organic waste and to provide employment, rooftop growing must be profitable. Wilson, G., (2002) shows that in the medium-term urban cropping systems may generate a positive net gross margin. In developing countries, horticulture on buildings, mainly on rooftops, is gaining in importance and allows production of various vegetables, fruits or flowers. For instance, in Senegal rooftop gardening, based on bricks or wooden box beds filled with compost, allows growing a wide variety of crops, including: fibrous roots crops, tomato, hot pepper, eggplant, etc. (Deesohu Saydee and

Ujereh, 2003). Such cultivation is characterised by its high level of intensity due to very small spaces available on the roof of buildings. They use either hydroponics or organoponics (often in containers, boxes, pots or cells). A positive effect of rooftop gardening is that planted roofs improve the thermal performance of a building. They block solar radiation and reduce daily temperature variation and thermal ranges between winter and summer (Eumorphopoulos and Aravantinos 1998). The effect of rooftop gardens on reducing the energy consumption of commercial buildings was measured to be up to 14.5 percent in Singapore (Wong et al. 2003). Singapore has developed a project of greening by planting trees, shrubs and grass in the city in order to maintain a pleasant living environment. Roof gardens, though not a new concept, increase the percentage of greenery in urban built-up areas and bring back the vanishing urban green space. Sprucing up the originally under-utilised portion of the buildings, they can 'create a new network of vegetation linking roofs' and increase the ratio of greenery to people.

Due to being located outdoors, these systems face natural attacks, e.g. of insects and birds, and some crops would therefore need protection. The issue of the crop residues produced by such systems is also a consideration in the urban context and could be a limiting factor in the development of agriculture, if not accounted for in urban planning.

Permaculture

Due to the limited area for cultivation and the constraints this poses, agricultural activities within the city have to be efficient and with minimal impacts on the environment. Some integrated systems called 'permaculture' have been developed to meet these requirements. They combine growing fruits, vegetables or grains with keeping livestock by creating a symbiotic ecosystem, with an ethical foundation in sustainability and copying nature, and a scientific basis in ecology. Permaculture (for permanent agriculture) is particularly relevant in the context of UPH because it is a flexible option that suits city conditions due to the local recycling of energy and resources. The variety of production limits the risk and gives financial security. It is well suited to the developing countries because external inputs (chemical fertilizers, pesticides etc) are limited or absent.

Permaculture can be considered as one ultimate cropping system concept that uses a wide range of techniques and concepts: rainwater collection, excrement composting, reusing and recycling resources, saving energy, green building and planning, developing the local economy. For example, in London (UK), Becontree Organic Growers in Dagenham develop the local economy through a local exchange trading scheme (Sherriff and Howe, pers com.). In Havana (Cuba), permaculture has been encouraged (Lazo and Barada, pers com.), where it has not only permitted the production of food, medicinal plants, spices and ornamental plants, but also resulted in a knowledge network by including a range of interested actors through periodic workshops, courses and conferences in environmental education and other related topics.

Imagen Educativa

Simple Hydroponics at a school in Peru

Conclusion

In many expanding cities in developing countries, UPH is already a large contributor in supplying fresh produce to city markets and is expected to remain so in the near future. On the one hand, the available land will decrease because of the need for industrial development and urban housing. On the other, the demand for fruit, vegetables and flowers will increase with rising standards of living and growing populations. Horticultural production units will evolve and adapt to new environments as cities continue to develop. In the future, vegetable production will remain essential as a source of high income and healthy food for growing cities.

Box 11.3 *Allotment Gardens in Cagayan de Oro, Philippines*

By R. J. Holmer

Cagayan de Oro, a city of about 600,000 people, is located on the central coast of Northern Mindanao in the Southern Philippines. It is representative for the numerous secondary cities that have rapidly emerged all over Asia in the shadow of the so-called megacities such as Manila, Jakarta or Bangkok. Out of its total land area of 48,885 ha, about 2,300 ha are under agricultural production, mainly for production of corn, fruits, root crops, rice and vegetables with eggplant, squash, string beans, bell pepper, horse radish tree leaves and bitter gourd as the most popular ones (Potutan et al. 1997). Apart from these commercial farms, other forms of urban horticulture also exist. The City Agricultural Office estimates that about 40 percent of all households (94,672 in 1997) maintain backyard gardens and produce mainly leafy vegetables, fruits and ornamental plants. 96 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 the principals and teachers. The size of these gardens ranges from 500-1000 m^2. The pupils usually plant leafy vegetables, fruits, ornamental and herbal plants. In some schools, parents are involved in maintaining and safeguarding these gardens. School administrators have adopted bio-intensive gardening, designed for pupils to learn about urban agriculture through both formal and informal approaches to education (Potutan et al., 2000).

Since 2003, a special type of community gardens, so-called allotment gardens, was established in four highly urbanised areas of Cagayan de Oro, particularly to benefit urban poor families. Allotment gardens are characterised by a concentration in one place of several small land parcels of about 200 to 400 m^2 that are assigned to individual families, who are organised in an association. In allotment gardens, the parcels are cultivated individually, differing from other types of community gardens where the entire area is tended to collectively by a group of people (Holmer et al., 2003). The production practices for vegetables in allotment gardens are similar to those in rural areas, but differ mostly in the choice of suitable cultivars and the reduced application of agrochemicals due to the proximity to populated areas (Guanzon et al., 2003). The perceived benefits of the allotment gardens in Cagayan de Oro are many (Urbina et al., 2005). While 25 percent of the vegetables produced is consumed by the family or given away to friends, 75 percent is sold to neighbours or walk-in clients who come directly to the gardens as they appreciate the freshness of the produce, the convenience of proximity as well as the lower price compared to the public markets. The gardening activities, a secondary occupation for all its members, have augmented the available income by about 20 percent while the vegetable consumption has doubled for 75 percent of its members. This is especially notable since the average vegetable consumption in Cagayan de Oro is only 36 kg per capita and year, which is half of the minimum recommended intake of FAO (Agbayani et al., 2001). In addition to these benefits, the gardeners particularly appreciate the strengthening of community values, which they have experienced by engaging in allotment gardening. The gardens are also essential for the successful implementation of the city's integrated solid waste management programme. The segregated bio-degradable waste from the neighbouring households is delivered to the allotment gardens where it is converted into compost. The amount of residual waste delivered to the landfill site from these areas has thereby been reduced by more than one third. The city government of Cagayan de Oro is presently mainstreaming this concept into its overall city planning and development, which will also use participatory GIS-based approaches to identify suitable areas for future allotment garden sites.

Vegetable production provides regular and high incomes to the various actors in the commodity chain and provides food to urban dwellers. For instance, in 1999 in Jakarta (Indonesia), UPH fruit production supplied almost 20 percent of the city's demand. Worldwide, about one quarter to two thirds of urban and periurban households are involved in agriculture. In the coming decades, fruit and vegetable production will continue to play a key role in feeding cities and providing activities and incomes to farmers. To answer consumers' demand and to produce healthy fruits and vegetable in a manner that respects the environment and producers, it will be necessary to combine agro-technical solutions with urban planning. Many specific techniques have been developed or adapted specifically for urban areas but there is still some research needed in order to better understand these complex anthropised agro-systems. Systems such as permaculture that combine various forms of production can be very complex ecologically. It is therefore important to undertake agro-technical studies that could provide more in-depth on the conditions required for obtaining good-quality vegetables. Urban planning should help to provide optimal conditions for urban gardeners (See chapter.3).

So, with a view to current and future technology transfer, all stakeholders in the commodity chains have to be involved in developing better conditions for integrating fruits, vegetables and flowers as part of UPH. Supply of inputs and materials, management of crop residues and linkage between activities are key points that need to be taken into account early in the urban planning process. It involves all aspects of a city's organisation and requires commitment to provide goods and services to agricultural activities and people (Pinderhughes 2004), (see also chapter 1 and 2). The case of PROVE (chapter 7), also shows that additional income can be gained by (poor) urban producers if less intermediaries are involved in getting their products to the consumers.

Various functions of UPH have been mentioned in this chapter. The food supply function remains the most important, even though economical, social (labour), cultural, living environment, environmental (recycling) and security (food and natural risks) functions appear to be essential too. More than any other agricultural system, UPH has a multifunctional role that should be taken into account by researchers and policy makers. Implementation of an urban planning policy that includes the sustainability of this form of agriculture is a necessity for well-balanced urban development. UPH plays a substantial role in the development of local (micro)enterprises, including input supply, processing and marketing. It also reduces the distance that fresh food needs to travel from producer to consumer.

If well managed, urban horticulture can play an important role in reducing socio-economic and environmental problems in cities. Planners and policymakers should develop and support community-wide plans to improve poor people's incomes using urban organic waste, to improve urban food safety and to create sustainable food systems.

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Dry and aquatic peri-urban and urban horticulture in Hanoi, Vietnam

Hubert de Bon

In Hanoi (2.8 million inhabitants, 921 km^2), horticulture is practised all over the city. Hanoi Province is divided into seven urban and five periurban (or rural) districts. The mean farm size varies from 1600 m^2 in urban districts to 3200 m^2 in peri-urban districts. The average household labour involved in horticultural production is around one person in urban districts and 1.5–2 persons in periurban ones. Hanoi is surrounded by rivers which flood during the wet season from June to November, and is a significant constraint to horticulture. Despite the humid subtropical climate, all crops are irrigated.

Nguyen Thi Dieu Phyuong

Water mimosa production

In urban districts, the main crops are leafy vegetables (kangkong, Chinese water spinach, water morning glory and choysum), flowers and ornamental citrus tree (*quat*). Kangkong is grown in the Hanoi area, in the two urban districts of Than Xuan and Dong Da, as well as in the Thanh Tri southern peri-urban district. Kangkong (water convolvulus) is grown in water and in a dry system. The aquatic production occurs in lowland areas and canals filled by rainwater and sometimes domestic wastewater from the surrounding houses. In the urban districts, the main sources of wastewater are city drainage and households. Whatever the quality of the water, kangkong grown in water is considered to be the best. The growers are essentially older women. In the two urban districts, only five families are occupied with this production, which contributes only part of their household income. Harvesting is done every two or three weeks; the young shoots of 30–40 cm are cut and sold by the bunch. Sometimes, pesticides are applied on the foliage. The produce is sold directly in the street markets or, during the main harvesting period, at the wholesale night markets in bulk.

Ornamental plant production has developed in connection to the Tet (Vietnamese New Year) celebration. Citrus kumquat with orange fruits and blossoming peach trees are traditional gifts for the Vietnamese New Year. All around the lake Tay Ho, just before Tet, there is tremendous activity in sales of ornamental potted trees and blossoming peach-tree branches. Usually, the potted trees come from nurseries with a nine-month cycle in the inner districts of Hanoi. The young trees are brought from areas further away in the eastern provinces, such as Hai Dung, and transplanted in the nurseries of Hanoi. The Hanoi cycle demands large quantities of soil which are brought every year, between the Tet harvest and the time of transplanting. Many lorry loads of soil are dumped around the lake in order to replace the 10-cm layer of soil removed by the production of trees for the Tet festival. Uniformity in the size of the orange fruits is obtained by applying hormones. The pyramid shape of the trees is gained by tying up the lateral branches with wire.

In the five peri-urban districts, vegetable production is very diverse with many specialised niche markets. Around 100 vegetable species are grown. For instance, the wax gourd (*Benincasa*) is grown mainly for small enterprises that produce crystallised fruits also sold during the Tet festival. Gherkins are grown for pickles. Recently, rose production for the local market and for export to China during the winter season has developed very quickly to reach around 1000 ha of production in the Tu Liem District. Thus, there is horticultural production that feeds the processing and export sectors which take advantage of the city infrastructure (railway station, roads, access to power and services). On the other hand, there is also the cultivation of species that require short marketing chains from harvest to consumer, such as choy sum, Indian mustard, garland chrysanthemum, amaranth, lettuce and young shoots of squash. In this type of production, the grower tends to apply diverse chemical pesticides in order to obtain a good green leaf free of insect and disease damage. Thus, it is necessary to develop techniques that will reduce the use of chemicals. If chemical spraying is chosen, it is necessary to identify clearly the pest and the disease to be able to use the correct and most efficient chemical among those that are officially authorised. A recent on-going project (SUSPER: Sustainable Development of Periurban Agriculture in South-East Asia) has proposed the development of a physical barrier method. To protect the leafy vegetable crops, mainly crucifer, from insect attacks, farmers are advised to place tunnels of nylon nets with 500-micron stitches (or 32 mesh) over the crops. The mesh is small enough to keep out the diamond back moth cabbage worm (*Plutella xylostella*); a chemical treatment could be applied under the net if needed. For maximum efficiency, the net should not have any holes. To combat the stripe crucifer flea beetle (*Phyllotreta striollata*), the soil should be flooded 48 hours before sowing in order to kill all the pupae in the soil.

The political authorities are very concerned about the inappropriate use of chemicals. For instance, the Hanoi People's Committee has encouraged the development of a better-quality vegetable industry. One of the most successful initiatives is the setting up of safe vegetable production for specific markets, such as for school canteens, restaurants and high-income consumers. In comparison to the standard production, safe vegetable production is a good opportunity for maintaining vegetable production in the periurban area. Reducing the use of pesticides is a response to the risks of damaging human health and polluting the environment.

Peri-urban production is a successful example of market-oriented agricultural development that emerged after the 1988 and 1993 reforms. With 79 percent of the areas around Hanoi cultivated with rice, horticulture has a number of other functions than bulk food production: providing an income, protection against flooding, supply of fresh leafy vegetables (80 percent of leafy vegetables consumed in Hanoi come from Hanoi Municipality), providing specific vegetable and ornamental crops for processing and for export, maintaining the cultural identity around the villages, and the creation of an open space in a very densely inhabited area (this is of course together with the rice fields).

Case of Horticulture in Dakar, Senegal

Hubert de Bon

Dakar (2 million inhabitants, 550 km^2) is located in the far west of Africa and has a sub-Canarian climate, which is excellent for horticultural crops: an annual rainfall of 300–500 mm during the short wet season from June to October, followed by a dry season from November to May with relatively low temperatures due to the influence of maritime trade winds. In the area called Niayes, a large number of vegetable, flower and fruit crops such as strawberry, cabbage, tomato, lettuce, radish, French beans and Irish potatoes are grown. The large variety of vegetables grown is mainly for the local market but some of it also goes to the European market. The name Niayes is derived from the local word 'niaye' which means a depression between parallel sand dunes. Garden areas range from 1000 to 10,000 m^2. Horticulture is practised mainly with irrigation during the dry season, but is also rain fed during the wet season.

The traditional irrigation systems in the low-lying areas use water from the water table just below soil level. The soil is very peaty in the lower parts and becomes more sandier up the dune slopes. The fields are watered by hand from tanks twice a day. Manual irrigation demands up to 60 percent of the labour used for production. Sometimes, small electric or fuel pumps are used, which enables increasing the size of the plots. If domestic or urban water is available, vegetable farmers can negotiate a special price with the water companies to use this water for agricultural purposes.

IAGU-RUAF

Roof top gardening in Dakar, Senegal

Production during the wet system is limited by different factors. The areas for horticulture shrink because the low-lying areas between the dunes fill up with water during this season. Only a few vegetable varieties are adapted to the high temperature (around 29°C) and high humidity: hybrid tomatoes, eggplant, hot pepper, okra, watermelon, bissap (Roselle) and jaxatu can be grown during this season. Numerous pests and diseases have been identified on the different species: mainly insects (thrips on onion, fruit flies on solanaceous fruits, borers on cabbage, leaf miners on leafy vegetables etc) during the dry season; and fungi and bacteria (Phytophthora rot, bacterial spot on tomato) during the wet season. Throughout the year, everywhere in the sandy soil of Niayes, the root knot nematode (*Meloidogyne)* causes severe damage to various crops: tomato, lettuce, cucurbits, eggplant, okra etc. Different methods are used to control the development of this nematode: flooding during the hot wet season, using non-host crops such as cereals, and fallowing the land for several months.

In Dakar and in the Niayes area, a main constraint is the scarcity of water. The large size of the city limits the amount of water that can be used for agriculture. It is now forbidden to dig new wells to gain access to the ground water. Most of the horticultural growers complain that the water scarcity limits their production. The growers therefore have to increase the efficiency of water use and improve the profitability of production. There are two ways to deal with the shortage of water: 1) increase the efficiency of the irrigation system and 2) use wastewater. Improved irrigation systems have been developed: drip irrigation, hydroponics with water recycling, sub-irrigation by capillarity. These new systems have been tested by different projects with successful reduction in water use, but very few of these have been adopted by farmers. The use of wastewater seems to be a promising alternative. Wastewater is used after a first treatment in a purification station. An advantage of wastewater is that it contains some of the nutrients required for the growth and development of the plants, mainly nitrogen and phosphorus. This reduces the use of organic and chemical fertilisers on the crops. The risk of plant contamination and transmitting human pathogens can be increased by watering of the crops during cultivation and just before harvesting. Several low-cost systems have been tested in Dakar to improve water quality: waste-stabilisation ponds in the traditional form or with plants such as cattail (Typha) and water lettuce (Pistia). Another solution is not to apply the water directly to the crops but rather to use sub-irrigation and hydroponics. See also chapter 9.

Thus the main problem for sustaining horticultural production in Niayes area is the water requirement of the crops. The competition between agriculture and other urban activities (mainly the development of buildings) is very high. At present, there is still a place and a function for agriculture as long as access to water, whatever its source, is not too expensive, and as long as urban citizens recognise horticulture as a way of managing urban spaces and getting cheaper and fresher food.

Micro-technologies for Congested Urban Centres in Ethiopia

Yilma Getachew

Addis Ababa sustains 2.5 million people on a total area of 50,000 hectares of land, of which the concrete and asphalt build environment takes up around 20,000 hectares. In this congested city, the availability of land for food production is becoming very scarce.

The Government of Ethiopia had begun to promote urban agriculture. It is included in the research agenda of the Ethiopian Agricultural Research Organization (EARO), in the teaching agenda of Addis Ababa University, and in the development agenda of GOs, NGOs and CBOs in Ethiopia.

Organic agriculture emphasises diversity and provides both quantity and quality of food which in turn generates income to purchase other food. Ethiopia is blessed with natural resources conducive to organic food production. Its soils are fertile and living, and its water is hardly polluted by salts and pesticides. There is also an abundance of traditional knowledge.

Bio-intensive gardening is a method that capitalises on the forces of nature in all phases of plant development: growing, fertilisation and pest control. The method has four important components: production techniques; natural fertiliser techniques; natural pest and disease control techniques; and small-scale water harvesting techniques.

Yilma Getachew

Training of trainers in Addis Ababa

Production Techniques

The Biodynamic French Intensive Method

This method, according to Jeavans (1982), is a combination of biodynamic techniques developed in Germany and the French intensive techniques developed in France. The Biodynamic French Intensive method is a form of organic agriculture comprising three basic principles. The first principle is to grow plants so close to each other that when they mature, their leaves just barely touch. This creates a situation in which the microclimate and the living mulch reduce weed growth and conserve moisture. The second principle is the use of raised planting beds (60 cm deep). These plots have loose soil that allows for air, moisture and warmth together with sufficient organic nutrients that help roots to properly penetrate the soil. The third principle is to feed the soil (and not the plant) by using organic fertiliser and natural methods of pest control. In short, the method is less dependent on expensive external inputs, is space intensive, water conserving, depends on family labour only, and creates minimal pest problems. Families practising the method are likely to have well-balanced nutritious food and a better income from products that are grown without risks.

The FAITH garden method

There are numerous organic wastes in our kitchens and gardens that are not recycled to produce more food. Such wastes include: weeds, grass, leaves, kitchen waste (peels, organic refuse, egg shells), livestock manure, ash, hedge clippings, hair trimmings, chewed sugarcane, etc. The FAITH method includes basket gardening that makes use of these wastes to produce food. This technique requires bottomless baskets to be placed on the top of a hole (30 cm diameter x 30 cm depth) dug into the ground. All kitchen and garden waste is dumped into the hole. At the same time, desired vegetables and fruits are planted about 20 cm away from the basket. Through their root systems, the plants extract moisture and nutrients from the fermenting waste. This method produces organic food and fertiliser, conserves water and protects plants.

The Barrel garden

Imagine producing over 25 plants of Swiss chard or strawberries in a space less than one square metre? The materials needed to do this are a 200-litre barrel, a corrugated iron sheet, soil mixture (preferable 2 parts soil to 1 part aged manure or compost and 1 part sand), and manure tea.

Several incisions of about 12 cm each should be made around the barrel. The upper lips of the incisions are hammered inward and the lower lips outwards. The incisions should be made in intervals of 15 cm horizontally and 20 cm vertically. The barrel top is open while the bottom is perforated with about 10 holes. A rolled corrugated iron sheet is placed in the middle of the barrel and filled with sand. The space between the inner wall of the barrel and outer wall of the corrugated iron is filled with the soil mixture described above. Vegetables or fruits of choice are planted in the space between the two lips of the incisions. Regular watering is done through the sand in the middle. Manure tea is applied on a weekly basis through the sand in the middle. The barrel should be maintained over gravel for better aeration and drainage.

The benefits of this technology is that it enables families to increase the availability of micronutrient food and encourages the reuse of old barrels and trashcans (which are freely and cheaply available), the composting of organic solid waste, and using livestock waste as manure tea.

The Trench Garden

The trench garden method is interesting in situations where malnutrition (of macro-nutrients) and excess of livestock manure go hand in hand. The technology requires seed potatoes, aged manure and mulching material. To develop the trench garden, one needs to dig a 30 cm wide, 30 cm deep and 6 meters long trench. At the bottom of the trench, the soil should be cracked to a depth of another 30 cm to allow better aeration and drainage. After planting the seed potatoes at intervals of 30 cm, the trench is completely filled with aged manure in between plants. After two months each potato plant will yield one or two tubers per week, or about 2 kg per week, per trench, for duration of two months. After two months, the trench is refilled as before, which will continue to supply the family with potatoes for another two months. Depending on the availability of garden space the family can build several such trenches..

Yilma Getachew

Trench Garden

Management of Bio-Intensive Gardens

Apart from the production techniques, the bio-intensive garden practitioner needs to fertilise his plots, apply pest control and use water efficiently. Sustaining soil fertility in the natural way is the most important component in the organic farming/gardening strategy. There is a basket of choices of organic fertilisers that can be categorised as manure-based, legume-based or biomass-based. Additives like wood ash, bone meal, egg shells, etc. contribute greatly to organic fertilisation, by producing potash, phosphorus, calcium and iron if the soil micro-organisms are allowed to work on them.

There are three approaches to keeping pests and diseases at bay, the natural way. The first step is to have strong healthy plants growing in healthy living soil so that they can build resistance. The second is to fight harmful insects through beneficial insects and animals such as ladybirds, praying mantises, wasps, lizards, birds, etc. The third is to apply natural pesticides such as pepper, tobacco, pyrethrum, stinging nettle, etc.

Three major categories of activities aimed at the efficient use of water can be mentioned. The first is harvesting water during the season of plenty, for use when there is less water - roof water harvesting, ponds and artificial lakes are some examples. The second is to conserve the available water by mulching, shading, precision planting, etc. The third is recycling water or reusing it for a second and third time depending on the previous use.

Promoting Bio-Intensive Gardening in Ethiopia

Relying on the natural resource base, simplicity, affordability and productivity are the features on which training on these techniques is designed to respond towards greater sustainability, replicability and equity. To date, 800 families have participated directly in the training programmes on bio-intensive gardening in Ethiopia. Replication of the technologies amongst the communities is reported to have reached 8,000 families. The trainees are a mix of male, female, urban and rural dwellers. A typical module for a demonstration training plot is about 70 m^2.

Opportunities and constraints in Ethiopia

Illegal land occupation, use of contaminated downstream city rivers and the absence of urban agriculture in city planning are forces that have discouraged this approach in Ethiopia. However, through years of campaigning by environmentalists and agriculturalists, urban agriculture is now recognised by policy-makers and has been included in the master plan for more than four cities and towns, with others to follow.
The market is a real problem in the Ethiopian rural setting as far as vegetables and fruits are concerned. Traditional diets being predominantly cereal-based and fruits and vegetables being perishable are the main reasons. The overall poverty situation contributes to poor consumption and production of food rich in micronutrients.

Training in the bio-intensive approach to urban agriculture began in Ethiopia ten years ago. Since then, training sessions have included youth clubs, women's clubs, pensioners' associations, extension agents, farmers, school teachers and students, NGO workers, etc. In all these cases, the training sessions had limited hands-on practical sessions due to a lack of permanent demonstration plots. Thus the need for establishing a school of urban agriculture has surfaced, and is supported by several NGOs and governmental offices.

Recommendations

Urban agriculture is accepted as a policy by the Addis Ababa city administration and the city planning has set aside land for the purpose. What is not well understood by the authorities, however, is the potential of the organic option to urban agriculture and the available technologies. Seminars, workshops and publications need to address this issue. The poverty eradication strategy of the country needs to include urban agriculture as one among the important tools in the fight against poverty in urban areas.

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Vegetable production in Yaoundé, Cameroon

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Yaoundé, the capital city of Cameroon, has around 1.5 million inhabitants with a population density of 5691 persons/km². Situated at an altitude of between 700 to 1200m, 60 percent of the administrative area of Mfoundi is devoted to agriculture. This choice is reinforced by the geography of the land: swampy and flooded lowlands, hills and steep slopes. In the equatorial climate of South Cameroon with four seasons (1600 mm annual rainfall), peri-urban production has the advantage of providing a regular year-round supply of fresh and perishable products, independent of the condition of the roads. The horticultural sector includes fruit-tree nurseries and orchards, ornamental plant production, vegetables and staple foods. Peri-urban production takes place within the administrative borders of Yaoundé municipality at a distance of less than 50 km from the city centre. It develops steadily following the axes of urban development (roads, rivers and canals) in the numerous lowland areas where water is easily available and no building is permitted. Agronomic conditions in the lowland areas favour vegetable production. In total, there are 14 streams that could be sources of water for horticulture within the municipality.

According to a survey carried out in 2002, most of the periurban farming households (71 percent) have a second, non-agricultural source of income. More than 60 percent of the farmers are women. The non-agricultural income is derived by an occasional job (worker, joiner, bricklayer etc) or a permanent job (employee or civil servant). Only in 20 percent of the cases did the non-agricultural income predominate in this type of periurban agricultural household. On the other hand, farms larger than 5 ha require full-time workers to maintain operations. The average acreage of farms is 0.49 ha. More than half of the farms use external supplies of organic matter. Around 40 percent of the farmers also keep livestock (poultry, pigs, goats, or fish).

The two main vegetable-growing systems are the lowland system and the upland (or plateau) system. Various vegetables are grown: the “fruit” types such as tomato, chilli pepper, sweet pepper, okra and eggplant; the large leafy types such as leeks, lettuce; the more African-type vegetables; and the aromatic types such as basil, parsley, celery, mint, black nightshade, amaranth and jute mallow. Tomato and chilli pepper are more frequently grown in the uplands; leafy vegetables are the most common in the lowlands. Pests and diseases of vegetables are major constraints, mainly in the case of leafy vegetables of indigenous and exotic species, for instance, septoria spot and fusarium rot on celery, septoria spot and nematode on parsley, and damping-off and leaf miners on jute mallow. Insecticides and fungicides are very often used to protect vegetable crops.

In the plateau system, the cultivated crops are mainly staple foods (eg. yam, tannia, plantains and banana, maize, cassava etc) and fruit trees. Around one third of the upland farmers also grow some vegetables. One third of the farmers grow only African-type vegetables, while 10 percent are specialised in European-type vegetables such as tomato, eggplant and leek. The vegetable producers are located mainly in the lowlands and on the lower parts of the slopes.

Peri-urban horticulture in Yaoundé has different functions: i) supply of the local markets as well as home consumption, ii) land development, iii) employment and income generation for vulnerable people, and iv) use of urban animal and plant wastes as well as city waste. Integration of horticulture, livestock rearing and agro-industries is favoured by their geographical proximity within the peri-urban area as well as the proximity between research institutions, development agencies and farmers. Integration decreases the costs that local councils, industries or farms would make for recycling organic matter. It reduces costs to be made by the horticultural producers and contributes to the sustainability of periurban horticultural production. Recycling waste could be a way to maintain and develop horticulture in and around the city in the future.

Resources

Agroecological Innovations
Norman Uphoff (ed.). 2001. London (UK): Earthscan. 328 pages. ISBN: 1 85383 857 8 (paperback); 1 85383 856 X (hardback).
This volume presents both key concepts and operational means for reorienting agricultural efforts towards more environmentally friendly and socially desirable path approaches to the pressing problem of food security. It is a vitally important guide and resource for professionals and policymakers involved in agriculture and food production. Website: www.earthscan.co.uk

The Origins of the Organic Movement
Philip Conford. 2002. Edinburgh (Scotland, UK): Floris Books. 287 pages. ISBN 0-86315-336-4.
Organic production receives increasing attention from governments, scientists, retailers and producers. This book gives detailed explanations about the basic principles of the organic concept, and presents the most important dimensions of organic food production. It is interesting for reasons of history, state-of-the-art or simply to gain a better understanding of the subject.

World Markets for Organic Fruit and Vegetables. Opportunities for Developing Countries in the Production and Export of Organic Horticultural Products.
FAO/ITC/CTA. 2001. 317 pp. CTA number 1055.
This is a comprehensive guide that explains almost all that an interested trader, exporter or producer needs to know: What are the requirements for producing and exporting organic products to major markets? What are the characteristics of the individual markets of countries in the EU, in the USA or Japan? Who certifies what, which labels mean what, what is local competition? This publication is based on a study commissioned by FAO, CTA and the International Trade Centre (comprising UNCTAD and WTO). It contains a significant amount of useful facts (by CTA).

Home Hydroponic Gardens and Simplified Hydroponics (Hidroponia Simplificada).
2000 (Spanish Translation 2002) P Bradley & C Marulanda. Global Hydroponic Network. 2000.240 pp GHN, PO Box 15, Corvallis, Oregon 97339, USA,
Hydroponics reduces land requirements for crops by 75% or more, and water use by 90%. Simplified hydroponics is a vegetable production method that utilises modern-day hydroponic technology adapted for areas with limited resources. The technology is explained in this book, accompanied by careful and detailed texts and superb step-by-step coloured illustrations. It gives methods and construction techniques for building hydroponic gardens on waste lots in towns, in backyards, on rooftops, with experiences from Zimbabwe, Senegal and Colombia.

www.cirad.fr/en/pg_recherche
The site of the French organisation CIRAD contains a wealth of information on fruits and horticultural crops, and provides and links to projects and other institutions.

www.puvep.com
This is the site of the PUVeP (Urban and Periurban Small and Medium-Sized Enterprise Development for Sustainable Vegetable Production and Marketing Systems) on periurban vegetable production, consumption and marketing in Cagayan de Oro (Philippines), Ho Chi Minh City (Vietnam) and Vientiane (Laos).

www.avrdc.org
The World Vegetable Center provides documentation and seeds in order to improve production and consumption of vegetables.

www.carbon.org
This is the website of the Institute of simplified hydroponics, which links several projects and presents detailed techniques and examples of applications.

www.uwex.edu/ces/wihort
This site of the University of Wisconsin-Extension is a very complete source of information on gardening and horticulture.

www.reddehuertas.com.ar
The Network on Gardens in Argentina "Red de Huertas" (in Spanish) produces an electronic bulletin "INFOHUERTAS" aimed at linking community development and organic gardening. It is a meeting place of many different gardeners, and it is linked to the national programme: ProHuerta.

www.hydroponictech.com/
Hydroponic Tech is a site is for those who want to grow hydroponically but have found the cost of commercially available hydroponic equipment prohibitive.

www.permacultureactivist.net
The Permaculture Activist is a North American periodical. The website includes general information on permaculture; e.g., a list of sites on permaculture technologies, and a virtual library on permaculture.

Chapter 12

Livestock keeping in urbanised areas, does history repeat itself?

Livestock keeping in and around cities is a practice that can be traced back to ancient times. The functions and forms of urban livestock have changed over time, and after decades of neglect, the roles of urban livestock are now being recognised again by urban officials. This chapter reviews the categorisations, relevance and logic of urban livestock keeping in past and modern society. It stresses that animals can be both a nuisance and a benefit, serving several direct and indirect functions in urban ecosystems, each with different priorities at household, city and national level.

'For want of a nail the war was lost …'
ancient story

'The city requires an awful lot of countryside to be able to breathe'
Geert Mak

Livestock keeping in urbanised areas, does history repeat itself?

Hans Schiere
Eric Thys
Francine Matthys
Barbara Rischkowsky
Jaap Schiere

Introduction

Livestock keeping has been and is important in and around ancient and modern cities (Waters Bayer, 1996; Schiere, 2001). It is but one form of urban agriculture, and it often occurs in integration with others such as urban horticulture. Animals were kept in biblical towns, in ancient and medieval cities of Europe, and in Mayan as well as Chinese civilisations. Horse-, camel- and/or bullock carts carried - and continue to carry - goods and armies. Many 'modern' cities still have 'cow-streets' and 'hay-markets' as remnants from times when livestock was part and parcel of urban life. Just 100 years ago, the city of Copenhagen fed cows with the 'wastes' of beer production, and rabbits thrived on London balconies in World War II whilst sheep "mowed" the lawns of Capitol Hill. Even today, slum dwellers get extra cash from backyard chickens, the urban elite keep pets , and urban livestock actually helps to remove organic wastes while being blamed for causing pollution. Strangely, the Victorian English were glad to see horses being replaced by cars because that would *reduce the pollution* (=horse dung). No doubt livestock keeping in urban conditions has its drawbacks, from being noisy and smelly, to causing serious pandemics such as SARS and illnesses such as tapeworm infections.

Urban livestock is now being (re)discovered by officials, research and development workers, but it exists regardless of official recognition. In many countries livestock or urban farming is an activity that does not have an official status. For example, officials of Mexico City denied the presence of pigs on roofs of apartment buildings until they found animals walking in the rubble in the aftermath of an earthquake that destroyed the buildings in the early eighties. When there is lack of official acknowledgement, research-, policy- and development agencies can neither address the risks, nor use the potential benefits of animal keeping in and around cities (box 12.1). In fact, livestock is often banned in countries where poor people depend on it for their livelihood. But also in wealthier places like Singapore, nuisance and pollution have been reasons for doing away with most forms of livestock keeping. Often, such bans are a reflection of a narrow view on the multiple functions of livestock.

UVPP

Livestock is part of daily life in Dar Es Salaam

This chapter reviews the categorisations, importance, opportunities and threats of urban livestock keeping around the world. In doing so, we support a livelihoods approach which stresses that a singular focus on food and/or income generation cannot do justice to the many functions of animals in society (Thys et al., 2006; or see the case of Sweden). The direct roles of livestock may be small but the indirect roles can be crucial, in socio-cultural and bio-physical aspects. Livestock keeping may fulfil crucial roles (see table 12.2), whether they can be quantified (income or physical health) or not (social networks and mental wellbeing). In addition to the livelihoods analysis, we stress the need for non-linear thinking that focuses on variation *and* similarity, as well as on inherent logic and necessity of urban livestock systems (Schiere, 2001). This chapter reviews short- and long-term action regarding livelihoods, public health, poverty reduction, CO_2 emissions and biodiversity. It also emphasises the need to address future priorities, and attempts to raise issues for discussion rather than to only settle disputes.

Box 12.1 *Historical differences between continents (UNDP, 1996).*

Urban agriculture in Asia was well established in the 19th century resulting in a tradition and recognition of benefits of recycling waste for agricultural uses. Up to date it is accepted as a normal urban function guaranteeing a continuity of development. Grazing of public land tends to be officially accepted, as most urban land use regulations based on Hindu and Muslim tradition allow livestock keeping in cities.

Urban agriculture in Africa also has traditional roots, but these did not fit into the image of urban space propagated by the colonial rulers in the 19th and early 20th century. This colonial image was taken over by other generations of public officials who undervalued and resisted urban agriculture until recently. In some African cities, eg. in Burkina Faso, livestock keeping is even illegal (Siegmund-Schultze et al., 1999). According to the law, the urban territory serves commerce, habitation, industry, handicrafts, public services, generally all activities related to urban life, and is not for keeping horses, cattle, donkeys, pigs, sheep, goats, etc.

In another part of the world, it was the American Indians in Latin America who managed highly developed, intensive agriculture systems which collapsed after the European takeover. Rapid urbanisation after the Second World War resulted in the re-emergence of urban agriculture in shanty towns. Large modern producers exist, but also small farmers use improved technology.

Importance and Categories of Urban Livestock Systems

The role of urban livestock is now recognised in many poor and wealthy countries. Although Box 12.2 and table 1 provide statistics that confirm the importance of urban livestock, there is more to it than data alone. Poor people tend to keep animals to cope with poverty, while wealthier sections of society justify the need for urban livestock to keep pets, and/or to secure a steady supply of animal produce. The functions and forms of urban livestock keeping vary, but we stress the need to look at variation *and* similarity. Variation is change (=development) in the forms and functions of urban livestock, as well as the recurrence of basic forms. In capturing this variation, we loosely characterise rather than strictly define urban livestock systems:

> *Urban livestock systems occur in a large variation of forms and functions, in and around densely populated areas, and they strongly interact with surrounding communities, poor as well as wealthy, at several levels of system hierarchy, as well as with rural areas.*

This characterisation complements the one on urban areas by UNDP (1996):

> *Urban encompasses the entire area in which a city's sphere of influence (social, ecological and economical), comes to bear daily and directly on the population.*

Characterisation instead of definition reflects non-linear system thinking. It prefers to use surprise and change rather than average solutions and standard approaches. For example, in non-linear thinking livestock can be a labour opportunity for poor people, rather than being a problem in terms of labour demand for wealthier groups; animal excreta can be a resource rather than a waste; and animals can help to clean the city by removing garbage rather than cause disease by producing garbage. Strict definition cannot do justice to the variation of systems - keeping of pets by urban elite, to industrial poultry keeping to goats in slums. Use of variation helps to see patterns that repeat themselves, which can be a basis to design classifications for useful discussion (Schiere, 2001; or see the case of Addis Ababa).

Some classifications use the difference between city-types, eg. between inner city and the outskirts, depending also on whether one considers relatively open or dense cities. It is indeed quite common to distinguish "rings", eg. urban (inner city), urbanising (fringe), and more rural systems. Such rings as in figure 12.1 are useful notions, but they are neither static nor isolated from each other. They also occur at different levels within and between neighbourhoods. For example, a poor lady keeping backyard chickens may live next door to a wealthy merchant in an affluent area, wealthy people produce left overs in urban restaurants that help poor farmers keep animals, and a small city may actually be part of a larger one. Less common distinctions are based on scale and the use of fossil fuel energy (table 12.2 and figure 12.1). They relate to issues such as community resilience, resource flows, social structure or CO_2 emissions. The recent outbreaks of SARS and avian influenza may require distinctions based on health risks, eg. by being especially alert for systems where waterfowl and people interact closely.

Box 12.2 *Relevance of urban livestock (based on Waters-Bayer, 1996; Schiere, 2001; Ramkumar et al., 2003)*

Over 20,000 households in Bamako keep livestock in town, and thousands more supply them with inputs or marketing services. Over one third of households surveyed in Harare keep chickens, rabbits, pigeons, ducks and turkeys. In Dar Es Salaam urban farming is the second largest employer after petty trade and labour, and 74 percent of urban farmers keep livestock. In Cairo 5 percent of households keep animals like chickens and pigeons. In Asia, eg. Hong Kong, Singapore, Calcutta or Dhaka, the raising of pigs, poultry and fish is widespread. Of a total of 546 households interviewed in four wards of Hue city, 188 kept livestock. Some 41 percent of the households in Hue City keep livestock: three households keep cattle, 101 keep pigs, 129 keep chickens, 36 keep ducks and 3 keep quail, in total 8 cattle, 309 pigs, 4988 chickens, 670 ducks and 1,700 quail. Some 80 percent of Dhaka's inhabitants keep animals. Around the world, there are close links between animal keepers and restaurants for feed supply and produce marketing. In poor quarters of Latin American cities such as Lima, La Paz or Mexico City, pigs, poultry and guinea pigs are raised in backyards and on rooftops. And a survey among 891 peri-urban cattle owners in Pondicherry (India) showed that 80 percent of them are landless and that the majority of them are women. Each of them own 1-3 heads of cattle and dairying contributes to 45 percent of the gross family income.

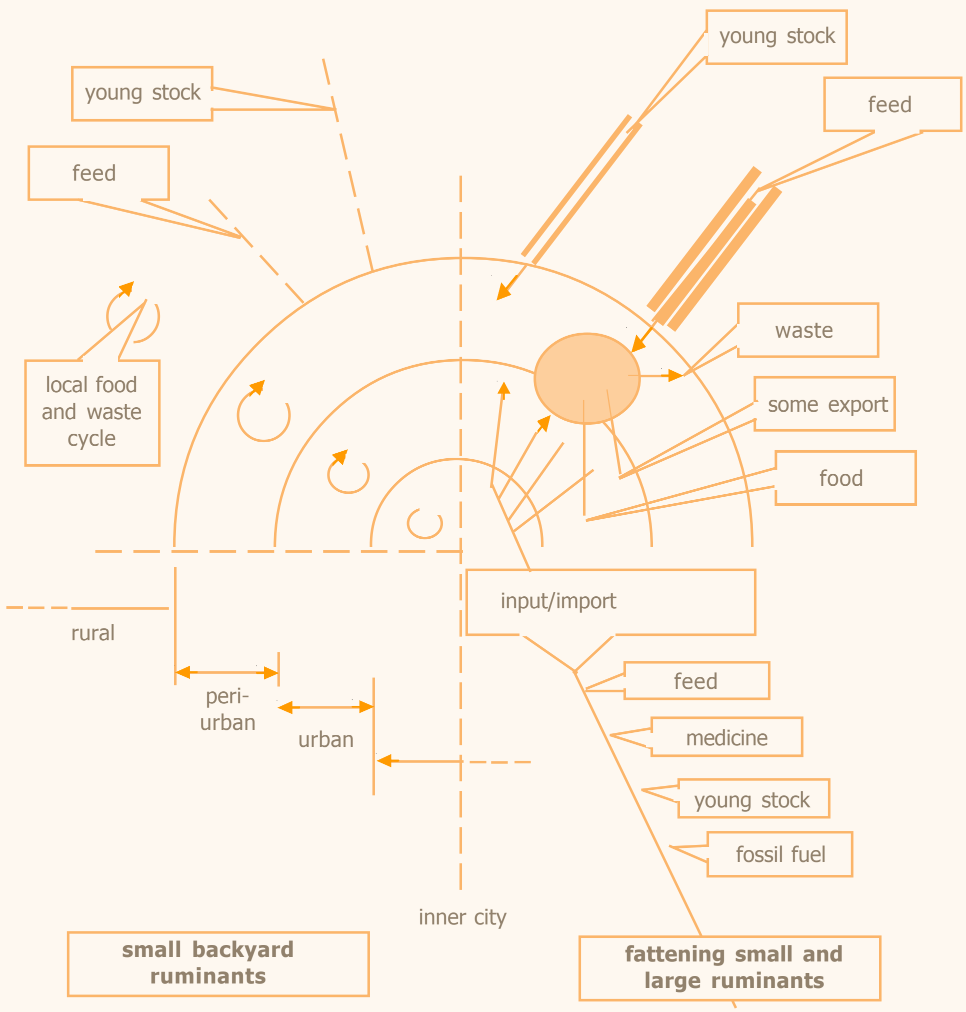
Table 12.1 *Annual per capita consumption of livestock products in Beijing*

	Per capita consumption (kg/yr.)			
	1985		1995	
	Urban	Rural	Urban	Rural
Read meat	26.0	9.8	34.5	12.8
Poultry	3.0	0.3	7.8	1.6
Eggs	14.0	5.6	16.6	5.8
Milk products	14.0	0.0	15.1	1.5

Based on Bingsheng, 1998.

Figure 12.1 a and b *System structure and aspects of control in different urban livestock systems*

In Figure 12.1.a and b, the scale, system structure and aspects of (social) control in different urban livestock systems is presented. It aims to show variation and similarity, as well as different magnitudes of resource flows and cycles. The concentric circles in both graphs represent resp. inner city, urbanising area, peri-urban regions and the rural districts. Small scale livestock keeping (left side of the two semi-circles) tends to use small animals and small enterprises, as well as local recycling and -thus- little waste as represented by the small semi-cycles with arrow. In this case some young stock and feed is imported from the rural regions, but animal keeping takes place mostly at local level (within-city). The large-scale enterprises (right hand circles) tend to use larger animals and/or larger production units. Feed, young stock and even skills, medicine and fossil fuels are largely imported from the countryside in case of bulky roughage for ruminants, and from external sources in the case of more sophisticated feedstuff. Leftovers from large-scale agro-industry are processed. The inflow of resources from bottom and top right can be considered as part of a cycle, if waste is not disposed of into canals and drains. In all cases the resource flows of the larger animals and enterprises are of a larger magnitude than those of smaller animals / enterprises, generally requiring more prime quality feed and (fossil) energy for transport. They, therefore tend to be under control of larger businesses than the livestock systems with smaller scales and cycles as depicted in the picture on the left. These sketches are based on personal observation and generalisation.



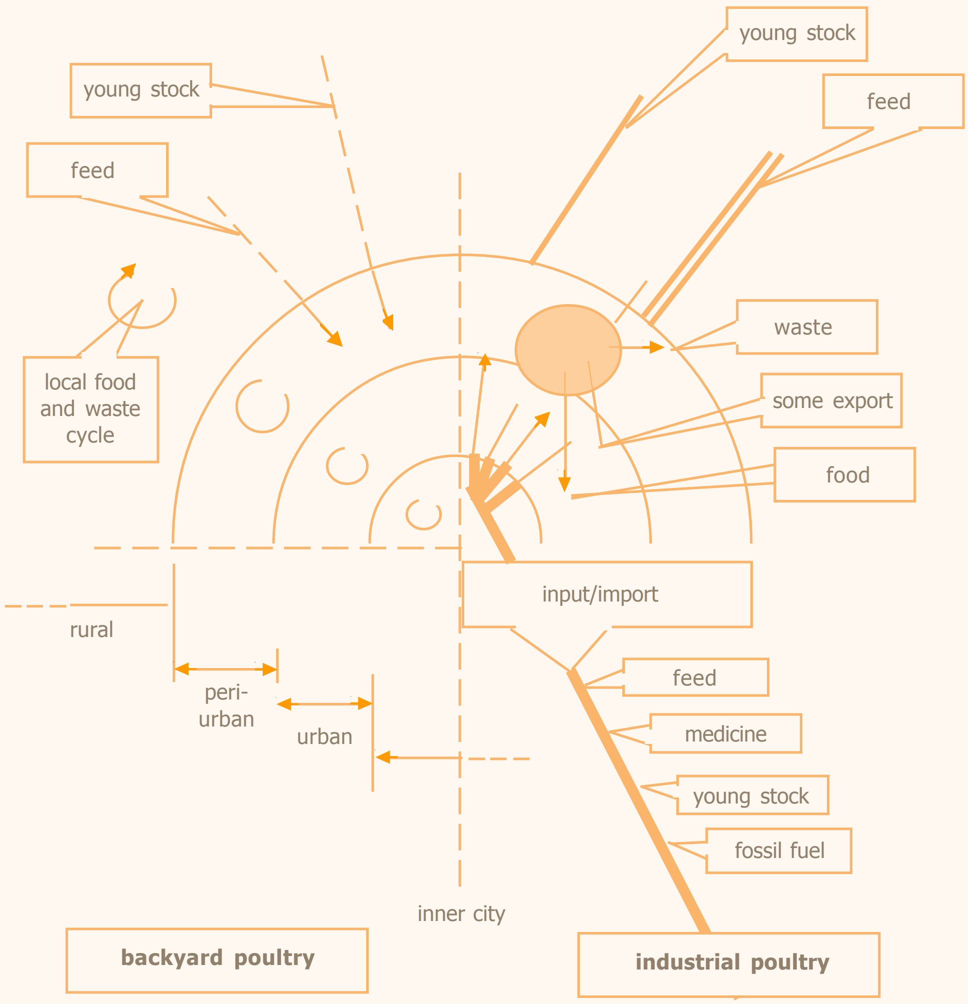


Table 12.2 *Categorisations of urban livestock systems*

Urban conditions	Type of enterprise	Production objective	Type of animals	Stakeholders
- Inner cities - Fringes - Garden cities - ...	- Subsistence - semi (commercial) - ...	- food/income - drought - dung - status - pleasure - ...	- pigs - layers/broilers - dairy-cows - rabbits - small ruminants - ...	- producers - consumers - housewives - banks - neighbours - ...

Based on UNDP, 1996; Waters Bayer, 1996; Schiere, 2001.
Note: dotted lines indicate that more patterns exist than shown here. Columns are divided by double lines since they are independent listings.

Table 12.3 *Issues of scale and energy use*

Animal system	Scale: Balcony/ backyard	Peri-Urban	Rural	Energy use	Stakeholders
Rabbit keeping	+++++	+++	+++	Low	Poor producers/ poor consumers (1)
Backyard poultry	+++++	+++	+++	Low	Poor producers/ poor consumers
Industrial poultry	----	++++	+++	High	Rich producers/ rich consumers
Beef production	----	++	+++	Low/medium	??? (2)
Sheep and goat keeping	+/-	++	+++	Low/medium	??? (2)
Dairy	+	+++	+++	Low/medium	Poor/rich producers/rich consumers

In this table approximations are used based on common sense and are meant to stimulate rather than to freeze discussion.

Note 1: exception proves the rule; rabbits etc. can also be kept on the balcony as pets by wealthy urbanites.

Note 2: question marks imply uncertainty regarding this aspect due to local differences.

Logic and Advantages of Urban Livestock Systems

The fact that urban livestock continues to be found around the globe implies advantages for local "stakeholders" to embark on some form of urban livestock keeping. These advantages could be in one or more of factors such as food supply, income, emotion, tradition, savings, ecological functions (like scavenging) and social coherence, in spite of the nuisance of a noisy goat or a smelly pig. Singling out of one of these factors would most likely miss out the essence of urban livestock keeping and agriculture in general; but simple calculations may illustrate processes that repeatedly lead to similarities and differences of such systems. For example, a simple calculation during a lunch break in Nakuru (some 150 km. west of Nairobi) helped explain changing functions and forms of livestock keeping when approaching the city (table 12.4). This common sense reasoning in 1997 strongly resembles the 'rings' found by the German economist Von Thünen some 150 years ago. Such calculations show how forms and functions of livestock systems change based on environmental pressure and/or socio-cultural attitudes. They also illustrate system dynamics and often unnoticed movements of resources and animals from rural to (peri)-urban areas for fattening or milking, now referred to as urban-rural linkages. Flows of young animals to the city as illustrated in figure 12.1 are often accompanied - in the case of dairy- with a reverse flow of dry and barren animals that recover on the range and are brought back to the city again for higher yields with higher density feed. These are given the term "flying herds" in urban livestock jargon. Milk is a valuable product in the city, where it can be too expensive to rear young animals. But milk in distant regions cannot be sold well where it makes more sense to raise animals. And feeds fetch higher prices when fed to animals in cities than in rural areas. Similar reasons explain why large-scale hatcheries are established in the countryside, while the actual production of eggs takes place in peri-urban regions. Factors such as climate, disease pressure, local politics and labour costs may complicate these processes but not the general patterns. In short, urban animal keeping has its advantages and disadvantages, like everything else in real life (table 12.5).

In fact, it is particularly the larger urban livestock systems that are linked to the rural areas and other urban systems, through exchange of inputs of feed, animals, labour, and outputs of cash for extended families in the rural areas or manure for vegetable farming (see figure 12.1). The resource flows from city to rural areas and vice versa are seen in West Africa where a part of Fulani families settle in the cities and keep high milking cows to sell the milk, while the main part of the herd is kept by other family members under pastoral production conditions. Dairy farmers in the Pakistani Punjab buy the best cows in rural areas soon after calving and keep them in cities to get high prices for the buffalo milk on the urban market (Seré and Neidhardt, 1994). Traders of forage in Maroua/ Cameroon tend to be farmers from the surrounding rural areas at a maximum distance of 40 km. In other words, the logic of urban livestock keeping is based on the positive roles of livestock in urban *and* rural areas.

Table 12.4 *Forms, functions, interrelationships and problems in dairy production systems*

	distance to the city			
	<3 km (<2km)	**3-10 km (4km)**	**10-30km(15km)**	**Beyond 50km**
Cost of concentrate	12 (14)	15 (14)	18 (15)	Not available
Price of milk	18 (10)	15 (9)	12 (8-9)	Not marketable
Milk yield at peak (l/day)	>20 (7.9)	Around 20 (5.7)	Around 10 (4)	5 to 10
Ratio concentrate/ (grass)	High	High/medium	Low	Very low
Type of keeping	Stall-feeding	Stall/grazing	Grazing/stall	Grazing/herding
Environmental problems	Dung disposal	??	damage to crops	Overgrazing
Public health hazard	Flies/parasites	Flies/parasites	??	???
Main production goals (=functions)	Cash/milk	Income/milk **security/asset**	milk for home/ **dung/income/** security/asset	tradition/calves **income/milk** for home
Milk market	Direct	Private vendor	Co-operative	Absent
Resources from other zones	Lactating cows, **grains**	Lactating cows, **breeding stock**	breeding stock	Dry cows
Resources to other zones	Dry cows	Dry cows	calves, lactating **cows**	calves, lactating **cowa**

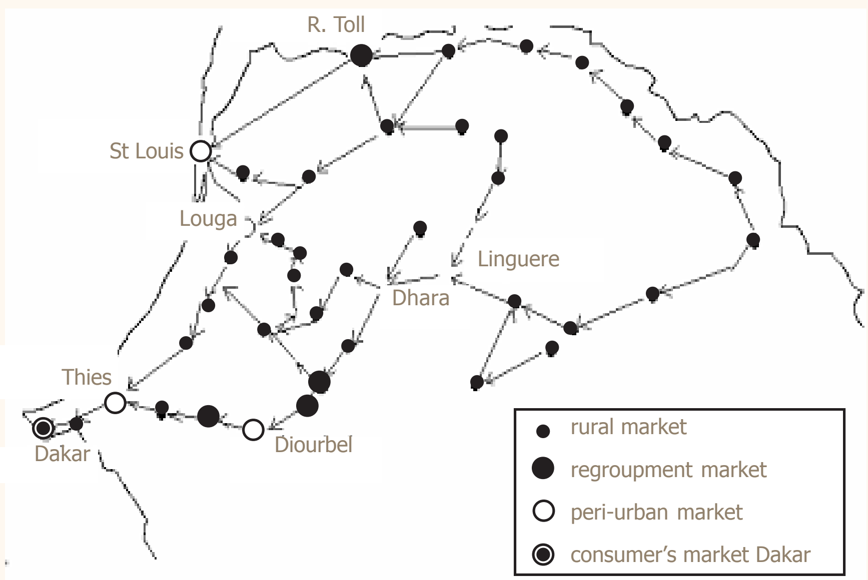
This table is based on a case from Nakuru (Kenya; prices in KSh/kg). The assumption is that 1 kg concentrate feed yields 1.5 kg of milk. In the first column (close to city) it makes sense to feed concentrates for milk, while it makes no sense to do so in areas far from the city. The row “milk market” comes from data collected at Pondicherry (India), as are the prices and yields between brackets (Ramkumar, pers. comm., 2004)

Table 12.5 *Potentially positive and/or negative aspects of animal keeping.*

Positive (or negative)	Negative (or positive)
- produce (healthy) food - use waste / clean or scavenge the environment - provide income and emotional value - status, savings, tradition - dung for garden - draught	- dung and urine disposal problems - disease risk - theft - zoonoses / hygiene - nuisance - much work

The list does not give absolute "values", it leaves final value-judgements on positive / negative aspects to local context and stakeholders' opinions, and in that sense some issues occur in both the left and right hand column.

Figure 12.2 *Movement of sheep from the countryside to Dakar (Senegal)*



This is from low to high energy density feed areas, and from producer to consumer (Diaw et al., 1999)

Disadvantages of Urban Livestock

Urban livestock keeping has its advantages, but also its disadvantages. Non-linear system thinking and common sense accept such trade-offs as a fact of life. But mainstream thinking tends to exclude livestock from cities almost across the board, e.g. due to notions of backwardness and risks associated with keeping livestock such as disease and nuisance. A complicating matter is that (in non-linear thinking) a disadvantage in one place can be an advantage elsewhere or for someone else. And indeed urban livestock does have its drawbacks, perhaps more than urban horticulture (see chapter 11). Some disadvantages threaten the general public, e.g. in the case of SARS and avian influenza. Others are just a nuisance, as is the noise of a goat *(in spite of so many other noises in the city)*, smell, dust, flies *(what about rats appearing if garbage is left uneaten by livestock)*, damage to gardens (*ignore damage by cars or house builders to trees and plants*), or a notion of backwardness implied in urban livestock keeping (*wealthy people like to show off with horses or exotic birds*) Table 12.5 lists advantages and disadvantages, which depend on stakeholders' priorities and conditions.


Anna Jonasson

Sheep roaming free in the city, Sweden

Following up on the earlier categorisations and rings of urban systems it is safe to say that problems of urban livestock increase with high concentrations of animals and people, particularly in unhygienic urban environments. Animals near homes and workplaces may be a nuisance to neighbours (odour, noise), clog sewage systems, cause traffic problems and/or contaminate water sources (UNDP, 1996). Pollution can be high in systems based on imported feed (the rich systems), not in the "poor" systems where animals serve to clean the environment by scavenging and eating leftovers. Animals may also cause disease and in-equality by increasing the workload of women and children, while at the same time contributing to their independence and health by providing essential nutrients or savings. Such contradictions are the core of what we call a "surprise" in non-linear system thinking and form the basis on which we stress the need for tailor-made solutions and useful categorisations. Participatory technology development gains favour around the world because it helps find local solutions for local problems, also in urban livestock keeping. And last but not least, it is the disadvantages that harbour opportunities, if properly addressed.

Critical Issues and Opportunities for Short and Long Term

Much is now documented on technical and socio-cultural aspects of urban farming and livestock keeping and major issues are summarized in table 12.6. Issues of short term-, farm- and society-level actions are covered in journals and books, in the other cases of this section, in the RUAF journal, in Schiere & Van Der Hoek (2001) and in handbooks and practical literature on backyard animals. Many practical cases of urban livestock are also known, e.g. as described for poultry and dairy in Eastern Africa by Sumberg (1998/1999) or by Tegegne (see the case on Addis Ababa), or on small ruminants in the USA (see box 12.3 by Bellows, et al,. 2000).

We therefore chose to address issues other than dung disposal or hygienic food preparation when discussing the future of urban livestock keeping. These 'other' issues are not more important than farm-level work, but they tend to get lost in the rush of the day and short-term solutions. And they do need policy back up, whether in poor or wealthy countries. By and large they are:

- global concerns regarding food security, poverty, energy use, CO_2 and biodiversity
- public health hazards from SARS to parasite infections and hidden issues of community 'health' like social cohesion and resilience.
- the need for flexible public administration and the notion of tailor-made solutions

The challenge is to provide new vistas for work with urban livestock, and one should not justify urban livestock because one happens to like it, or because it happens to exist. The future of good urban livestock keeping practices lies in the analysis of how and why it occurs, and on how or why it could be of use in the future. Some arguments overlap with those for urban agriculture in general, but livestock has its own issues such as dung and noise over pesticides and herbicides, or avian influenza over weeding and pruning.

Box 12.3 *Urban Livestock in the USA (based on Bellows et al, 2000)*

Urban livestock keeping in the USA is an activity that is hardly known and poorly regulated. Keeping animals in the city has multiple meanings for those involved and can be economic, cultural or religious. Successive waves of immigrants to cities in the USA from all over the world, as well as rural migrants from within the country, have brought with them the knowledge and practices of keeping rabbits, chickens, and occasionally goats and other animals for domestic use.

Livestock in the city is kept under diverse legal, illegal, and quasi-legal conditions. Since many of the livestock keepers tend not to be part of the dominant culture, issues of invisibility, distrust, and/or animosity between regulators and practitioners of urban livestock are occurring. This is founded more in the lack of attention paid by policy makers to food systems and food security in and around cities.

The following are opportunities and barriers to urban livestock keeping in the USA

Barriers

* Little known, unknown, and/or illegal experience on which no information is available
* Disparate and un-coordinated legal codes at municipal level on urban livestock keeping
* Space restrictions
* Inadequate knowledge and/or unsafe (eg. unsanitary) practices
* Cultural resistance to raising animals for food and other economic purposes
* Often practised by marginalised groups and regulated by elite groups.

Opportunities

* Survives because of economic need, cultural endurance, and social resistance
* Produces fresher and tastier meat
* Experiences brought by immigrant and rural migrant communities
* Local dialogue between practitioners and regulators can proceed in tandem with new developmentat international level
* Species for small areas like fish, guinea pigs, rabbits, and chickens incomplete
* Technical training; workshops; community engagement in urban livestock
* Community-wide food systems education
* *Community dialogue on food security needs*

Food security and poverty, energy and CO_2, biodiversity and scale

Work on urban livestock can be justified or criticised on many grounds, but an important set of arguments, concerns and obligations are contained in the international conventions such as Rio *(biodiversity)*, Kyoto *(on CO_2)* and Johannesburg *(food security and poverty alleviation)*. Put together, these obligations are painful, contradictory and inherently hard or impossible to fulfil. For example, how can the need for lowering CO_2 emissions be reconciled with the political urgency of creating jobs and increasing consumer spending? And how can notions to stimulate industrial animal production to supply increasingly wealthy urban consumers with animal proteins be reconciled with the approach of poor urban producers to consider animals as scavengers. Much of what follows in this chapter focuses on the keeping of livestock by the poorer sections of people in urban areas, focusing on small-scale systems with mostly small animals in slums and backyards, in balconies and on rooftops, as well as on larger animals in peri urban regions. Industrial systems require their own approach, but that discussion is beyond this chapter, in spite of the useful lessons that different systems can learn from each other, eg. regarding notions of multi-functionality (livelihood-analysis!), small-scale gardening or recycling, and re-establishing links between consumers and the countryside.

The above mentioned international conventions offer good arguments, particularly for keeping of smaller animals and related enterprises, for example:

- food security is served both by the actual supplies of nutrients and income, as stressed by the use of livelihood approaches. A focus on food-output by industrial systems overlooks significant roles of small urban livestock in terms of scavenging, and of producing local food where needed and affordable, thus supporting community resilience
- small and diverse animal production systems fit well in notions to enhance local (bio)-diversity. If well done, small scale urban agriculture can be a seedbed of diversity, in terms of ingenuity as well as resilience. The associated notion of "requisite variety" as it is called in academic terms, implies that systems need a variation of organisms [and sectors] to clean its waste, thus potentially increasing local hygiene.
- small scales tend to depend less on fossil energy than larger scales, eg. by requiring less transport, refrigeration and packaging, and may also better use local leftovers,. One study of food systems in the UK showed that a meal from imported ingredients generates nearly 650 times the transport and related CO_2 emissions than when made from the same but locally-grown ingredients (Halweil, 2002).

Table 12.6 *Areas for further work on a rather short-term and local scale*

Main category	Sub-topics
Marketing and input supply	Marketing strategies; pricing; information systems/ seed supply; young stock
Urban planning / land use management, incl. use of temporarily vacant plots	Land tenure, land-use and evaluation, decentralised urban development, intensification, forest and cities
Water & waste management; urban environment; public health	Waste water conservation, irrigation technologies, public health indicators, waste management, integrated pest management, organic farming, compost, recycling
Diversification of crop-livestock systems	Animal health, small ruminants, micro-livestock, fattening, diversification, rabbits and backyard chickens (or even snails and worms)
Feed resources / strategies	Crop-residue management, pesticide residues on feed, feed conservation and storage, ration formulation, post-harvest techniques and processing, alley cropping, fodder legumes

Note: prepared during a workshop on urban livestock in West Africa (ITC, The Gambia) in January 2005. They are mainly technical. The sub-topics were listed by participants, and clustered by Okike and Kofi.

Studies on the value of urban livestock for food alone is of little value or even misleading, as are more detailed studies on purely the numerical importance of livestock without speciation of categories, relations and multifunctionality. Studying the roles of livestock with livelihoods analysis can provide new clues for planners and policy makers. Work on issues like feeding of particular by-products is likely to be "*more of the same*" and is probably better done [in co-operation] with 'farmers' themselves who are the best location-specific experts. The future of urban livestock keeping depends on a better understanding of underlying issues such as food security, poverty alleviation, resource use efficiency, and trade-offs between these.

Public health and emerging zoonotic diseases

Disease risks of urban livestock systems are likely to need much more attention in the near future. This should, however, be a reorientation towards a more holistic focus on social issues and system specificity, moving away from a single focus on disease as a clinical issue. Recent cases of SARS and avian influenza in densely populated areas of Asia have made zoonoses a major concern in public health (Aldhous, 2005). Indeed, the combination of high densities of people and animals in the same location can increase the risk of disease, but is not true that industrial animal production necessarily increases these risks. Poor hygiene and a lot of direct contact between people and animals can have the same high risks. Disease is transmitted from animals to people in many ways, by direct contact and also through consumption of animal products. Some of this can also lead to epidemics and transmission from humans to humans, eg. in the case of yellow fever (Van Der Stuyft et al., 1999). Human health inextricably links to animal health and production, where animals play an important cultural and socio-economic role (WHO, 1999). Urbanisation causes changes in behaviour of humans in food purchases or contact with animals and pets and increases risks for spread of zoonotic diseases in poor hygienic conditions.

Zoonoses can be distinguished into viral (rabies, SARS, avian influenza), bacterial (eg. tuberculosis, brucellosis) and parasitic (e.g. cysticercosis and tapeworms) forms. Some viral forms, eg. rabies and avian influenza, are the result of direct contact between animals and humans. But others zoonoses such as yellow fever, plague or trypanosomiasis have animal carriers and are transmitted from animals to humans by mosquitoes, fleas and/or flies. Parasitic diseases could be tapeworm related as in hydatidosis and human neuro-cysticercosis (Van t'Hooft, 2000). Brucellosis and tuberculosis are linked to increased dairy production in the urban and peri-urban context, inadequate milk processing and uncontrolled market chains (Muchaal, 2001). Recently, Traoré et al. (2004) reported 13 percent brucellosis and 28 percent tuberculosis among intra-urban dairy cattle in Ouagadougou (Burkina Faso), but little is known on numbers of human cases of tuberculosis caused by *Mycobacterium bovis*. Also, tuberculosis is an opportunistic infection in HIV$^+$ persons in sub-Saharan Africa. *M. bovis* may also become opportunistic in HIV infected populations, as happens with zoonoses such as listeriosis.

Andres Dasso

Guinea Pig (Cuy) breeding in Lima, Peru. The materials needed are cheap and locally available.

Food-borne zoonotic diseases also become more important due to a higher demand for meat by a growing urban population. Poor slaughter hygiene can lead to contamination of carcasses, and larger scales can increase risks of mass-transmission diseases. Drinking water and vegetables contaminated with slaughterhouse wastewater can transmit pathogenic agents such as *Salmonella* sp., *Campylobacter* sp., and *Escherichia coli* producing toxins (Pal et al., 1999). Food that is poorly preserved in refrigerators due to frequent power cuts may amplify the problem of food contamination. These diseases, with the exception of toxin poisoning, can be transmitted from person to person, but little is known on the importance of these diseases. For example, diarrhoea is frequent and therefore considered rather banal in many countries, i.e., the causes are rarely investigated. In the early stages of the production process, contamination of feed with infected faeces (eg. *Salmonella*) can lead to infection in animals. Animal products can further contain residues of antibiotics or pesticides, and allergens from livestock waste or dust can cause occupational diseases in farm workers and proximity diseases in neighbours (McBride, 1998).

Katrien van 't Hooft

Traditional Cisticercosis control at a weekly market in Bolivia

The growing trend of health problems relates in part to the inadequacy and deterioration of public health and veterinary infrastructure in poor countries (WHO, 1999). For example, Coulibaly and Yameogo (2000) reported a lack of collaboration between public health and animal production services in controlling zoonosis in Burkina Faso. Currently veterinary services in many cities of developing countries seem more concerned by rabies and eradication of stray dogs (Meslin et al., 1996). On the other hand, the prohibitive costs of private or state veterinary services make smallholders reluctant to ask for help, and more so because they tend to be part of an informal or even clandestine sector. In addition, there are often no adequate testing facilities, farmers can easily evade the public health systems and many are unaware of the public health risks associated with keeping of animals in proximity to human populations (UNDP, 1996; Guendel, 2002).

In spite of all this, not much research has been up to now in comparing the specific risks of urban to rural livestock keeping. Real risks do exist, depending on the location (rural, peri-urban, inner city), the kind of livestock and the way they are kept. A survey among African experts from 27 West and Central African cities showed that only 43 percent of them had heard of diseases transmitted to humans from animals in urban contexts, but not all these cases were confirmed (Thys & Geerts, 2002). Protective frameworks are required to deal with the upward trends in disease occurrence due to increasing population pressure and densities and the multidimensionality of health. Intensification of animal production in and around cities combined with changing food habits make food safety a priority issue. Climate change coupled with increased population density can favour the further spread of vectors and diseases (Wittmann & Baylis, 2000; Ungchusak, 2005; Aldhous, 2005). In this context, there is a grave risk in paying too much attention to politically-sensitive diseases as SARS that divert interest away from more fatal disorders. Municipal, veterinary and public health services should work together and search for newer approaches because of the relations between human and animal health, and the socio-economic importance of animal production especially for the poorer people in the city.

Public administration and policy

The final 'higher-level issue' addressed in this chapter is the thinking about public policy, and the need for paradigm shifts. Steps are needed to move away from thinking in standard / linear solutions to one aspect (eg. to cure disease) toward approaches that consider combinations of factors (disease, population density, community organisation), multiple functions as stressed in livelihoods analysis, differences between communities, and surprise *and* tension due to different perceptions in participatory approaches. A few of the points that could be considered are that:

- it may be better to accept and regulate (in a non-linear way), than to ignore a sector that clearly fulfils a need of urban inhabitants. An example could be the provision of official status for selected forms of urban livestock keeping, particularly in urban zones where it is now illegal (see box 12.4). Possible systems are (cleanly kept) small animals such as rabbits, guinea pigs and small fowl on balconies and goats, sheep or even larger animals in the peri-urban areas. Waterfowl are a type of animal to be wary of with respect to avian influenza.
- educators, administrators and policy makers are key to rediscovering opportunities of urban livestock. Educators can teach hygiene and good forms of

urban livestock (Arias, 2002). Administrators may start by considering the differences between regions and the wealth of communities when addressing problems and opportunities. Policies that ban livestock can be enforced in [affluent] places like Singapore but they often promote illegal livestock keeping with associated problems of public health.

Box 12.4 *Legislation for urban livestock keeping in Burkina Faso*

The "decree" on the reorganisation of agriculture and land tenure of 1991 (KITI N°AN VIII-0328 Ter/FP/PLAN-COOP from 4th June 1991) indicates two categories of land: urban and rural (article 83). Accordingly, the urban territory serves habitation, commerce, industry, handicraft, public services and all activities related to urban life in general (article 84). This is further specified in another article (no 134) that concerns land reserved for habitation: "Keeping horses, cattle, donkeys, pigs, sheep, goats, etc. is forbidden in the urban centres." A note at the end explains that any exception to this rule needs authorisation from the respective authority. If animals are found scavenging in the streets with no one looking after them, the city representatives in conformity with a resolution of the community may seize the animals and impose a fine to release the animals to the owner (n°002/PHUE/CB from 29th of June 1995).

- innovative and generally participatory work is needed to show impact and sustainability.
- creative use of public statistics and record keeping can help to give urban livestock the status that it deserves. Too much focus on numbers can divert attention from the insights into how urban systems evolve.
- reassessment of national development plans is required. Many such plans invest public money in cheap feed and tax-holidays for investors and to ensure a supply of cheap animal products, while at the same time causing costs to society in terms of pollution, use of water and oil, and shifting food waste into landfills rather than to be recycled.

Fortunately, there is increasing awareness on the opportunities of urban livestock for poverty alleviation and food production. Several African governments even officially support urban agriculture now, eg. in cities of Mozambique, Zambia and Tanzania.

Reasons for this may be opportunistic, eg. Page (2002) argued that the government of Cameroon started to support urban agriculture as a safety valve for social unrest that was expected after salary cuts were announced for civil servants. Whether due to opportunistic politics or to enlightened individuals, change is possible.

Urban Livestock and the City of the Future, Concluding Comments

The final (and linear) question here is about our vision for the ideal city of the future. But, cities change over time, and perceptions of ideals differ among stakeholders. Most urban livestock keeping occurs in places of poverty, and in unsafe and unhealthy conditions. Livestock keeping in such places is a way to make the best out of the worst, rather than to perfect urban life as a stairway to paradise. In contrast, for the urban elite, the keeping of animals refers to pets, education, feeling good (case Ledin), getting tax benefits or hiding black money. In between these extremes are systems that have evolved out of a demand for fresh products, e.g. the case of milk described in the case on Addis Ababa. The obvious non-linear answer to the linear question is that there is no such concept as an ideal city or an ideal system of urban livestock keeping. Sketches of an ideal can nevertheless be useful, depending on the present and the thinking for the future. Such sketches include visions that consider cities as potential gardens and Utopia (box 12.5), or have utilitarian notions as found with Le Corbusier, i.e. considering cities as a good place for cheap labour to serve the economy, a step toward Utopia but at a different level.

Possible forms of future cities are suggested in the boxes, cases and literature of this section. Our 'ideal' would be a city (as a first Utopia) that is open-spaced, cooled by plants and shaded by constructions. Such a city should encourage citizens to experiment on small scale, exercising local control on major problems. Smaller livestock could play a good role in such systems. We know this will be hard to achieve, but one could, still aim for a city to incorporate aspects of urban agriculture where specific forms of livestock serve the combined roles of scavenger, pet, savings account, social activator, source of ingenuity and buffer, to name a few. Common sense can help to paint the outline, but more study is required to effectively address issues such as those raised in the global forums of Rio, Johannesburg and Kyoto. Such study should help policymakers to get to grips with ways to facilitate on-the-ground action to obtain more consistent results. Technical aspects of livestock production are sufficiently widespread to get started on the ground and/or to continue what is being done even without official recognition. Most of the issues need to be solved at farm level.

Box 12.5 *Historical developments and visions of urban conditions (Siegmund-Schultze, 1997)*

A concept that combined the advantages of city life with rural aspects was discussed in Europe since the middle of the 19th century. The 'ville-jardin' is a type of city that aimed at social reform, consisting of lots surrounding green spaces with employment nearby (Benevolo, 1983). Many such cities were actually established but the results were not very convincing. The idea of working where one lived did not really catch on and particularly the idea that the green spaces were left unproductive gave it a luxurious image out of this world. Another reform was set in motion by Schreber in Germany since 1864. For pedagogical reasons he introduced green spaces in industrial areas, which subsequently were transformed into 'productive' gardens. And another group of innovators denounced industrialisation and urbanisation as bad for public health. For this reason they introduced urban vegetable gardens many of which still exist in Germany, e.g. as 'Schreber-gardens' that serve recreational and productive aims often grouped as one or more spacious places in the heart of the city. The use of these gardens changed over time, sometimes serving as places for contemplation, recreation, pedagogical or social use, or even to provide essential food. In addition they improve the micro climate (Theobald, 1996). These models of urban development are alien to cities in the non-industrialised countries where the explosive rate of development has caused a shortage of transport facilities and a lack of planning. In these countries, development is more marked by spontaneous growth than by long traditions of urban planning, except in the colonial times.

Unfortunately, many "ideal" dreams belong to contexts that are far from ideal, often miserable urban conditions around the world. Urban livestock can provide small but crucial options for the poor, while it is often the wealthy and powerful who manage the large industrial enterprises which have their own problems of pollution and resource use. Livestock keeping by the poor is likely to continue in crevices, with animals being fed on what is leftover. At the same time and as is typical of non-linearity, it might be a crucial weakness and strength of urban livestock to function as a scavenger while providing food and livelihoods for the poor and the wealthy. A main weakness and strength in this respect is the multi-functionality of – scavenging- animals that cannot produce enough food for entire urban populations, but that serve more than one goal at one time. These functions are hard to administer by conventional thinking in public sectors, but it is there perhaps where programmes for urban livestock keeping need to turn their attention to, and where most gains can be made. Even rich societies might re-discover the benefits such as education or local employment, to re-establish links between consumers and producers, short cycles for energy and resource saving, and flexible rules combined with alertness for critical issues such as SARS or Avian Influenza (see box 12.6)

Keeping of animals has always been part of the city, and a link between the countryside and cities. Its potentials are slowly being rediscovered, while related issues require attention at farm as well as 'higher' levels. Urban livestock keeping is back on political agendas thanks to the efforts of pioneering women and men in slums, offices and the academia who see the advantages of this form of urban agriculture, in spite of inevitable drawbacks.

Box 12.6 *Supporting Endogenous Livestock Development (ELD): An alternative vision of livestock development for the poor*

The ELD initiative was born out of the concern that, in spite of renewed interest in livestock, the international debate did not seem to be leading to truly innovative approaches that could effectively support the poorest livestock-dependent peoples in the world. The ELD approach seeks to support poor and marginalised livestock-keeping communities, and has been developed by a group of people involved in various international networks related to livestock and poverty.

There is a need to focus specifically on the role of livestock from a people-centred perspective, based on the livelihoods and strategies of livestock keeping peoples themselves. This implies maintaining the multi-functionality of livestock, as well as focusing on the equilibrium between crop and animal agriculture. The bias towards crops that prevails within government policies, production subsidies, education and research, has often led to poor understanding of the livestock component. Though initiated on the basis of experiences in poorer regions of developing countries, Endogenous Livestock Development may have a role to play in more developed regions and countries as well.

The objectives of the ELD initiative are:

- Creating a global umbrella for exchange, collaboration and networking
- Deepening the understanding and implications of people-based livestock development
- Stimulating field-based ELD initiatives
- Influencing livestock policies, research and education

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Market-oriented Urban and Peri-Urban Dairy Systems

Azage Tegegne *Million Tadesse*
Yoseph Mekasha *Alemu Yami*

Urban and peri-urban dairy production systems are among the many forms of dairy production systems in the tropics and sub-tropics. These systems involve the production, processing and marketing of milk and milk products to consumers in urban centres (Rey et al., 1993; Staal and Shapiro, 1996). Urban and peri-urban dairy production systems have evolved in response to the increasing demand for milk in urban centres as a consequence of increasing urbanisation, rising per capita income and increasing costs of imported milk and milk products. They contribute to overall development through income and employment generation, food security, asset accumulation, poverty alleviation and improving human nutrition and health.

The development and sustainability of urban and peri-urban dairy production systems requires a relatively large initial investment and long-term commitment. In addition, the major technical and non-technical constraints associated with these dairy production systems such as the availability and cost of genetic materials, breeding systems, feed resources, feeding systems, animal health, processing, marketing, public health, waste handling, management, and policy issues need to be addressed. In this case study, the characteristics of the production systems, feed resources and feeding systems, genetic resources and breeding systems in urban and peri-urban dairy production in Ethiopia are assessed.

Azage Tegegne

Small ruminants play an important role in the household economy

A study on market-oriented urban and peri-urban dairy production systems in Addis Ababa was undertaken to characterise general dairy systems and specific sub-systems and to identify major constraints. A total of 147 dairy farms (market-oriented smallholder and commercial) were selected for characterisation, and 49 farms were used for a further detailed study.

Production Systems

Seven, market-oriented, dairy production sub-systems were characterised. The 'milk shed' approach considered systems that supply fluid milk to the city. Both rural and urban systems develop in a dynamic way and shifts between them occur. All these systems are basically market driven due to the large urban demand for milk. In fact they have developed in response to the market demand and have emerged depending on available resources (land, labour, feed, capital, etc).

Traditional crop/livestock farms in rural areas: These farms are located between 25 and 130 km from Addis Ababa, the average distance being 68 km from the capital. They are small farms with an average of four dairy cows, and provide very little or no specialised inputs (new breeds, supplementary feed, housing, veterinary care, etc) to their dairy enterprise. They sell fresh milk on a daily basis to the government-owned Dairy Development Enterprise

(DDE). Excess milk is processed into butter and a local cottage cheese (known as *Ayib*) and sold at local markets.

Intensified dairy/crop livestock farms: These are smallholder farms located around Addis Ababa and exercise some form of intensive dairying. These farms have had experiences with dairy development projects under the Ministry of Agriculture. Projects such as the Selale Dairy Development Project and the Smallholder Dairy Development Project have been operational in these areas and have influenced the production system on these farms. New genotypes, artificial insemination, improved forages, concentrate feeding, housing, calf bucket feeding and early weaning are common practices used by farmers. Compared to the traditional crop/livestock farmers, the land holding in this category is about half the size and milk production is 15 percent higher, but the number of cows per household is similar.

Crop/livestock farms with intensive cropping: These farms are located relatively closer to Addis Ababa city, between 25 and 60 km. The farms and herds are 25 percent larger than those of the traditional crop/livestock farmers. The cropping system is more intensive, particularly in terms of frequent fertiliser use. The animals are given supplementary feeds. Fresh milk is sold to the DDE and they seldom process milk into dairy products.

Specialised dairy farms: These farms are located between 15 and 60 km from Addis Ababa. They are large farms with an average holding of 8.9 ha and 17 cows. They widely use specialised inputs such as new genotypes, artificial insemination, forage production, housing, concentrate feeding, veterinary care, etc. They sell fresh milk in relatively large quantities of over 30 litres per day primarily to local informal markets or to the DDE. Most farm owners have additional off-farm activities that often generate more income than the livestock enterprise.

Peri-urban farms in secondary towns: These farms are located in and around secondary towns within 25 to 50 km from Addis Ababa. Cattle are grazed on own or rented land. Special inputs are linked to the genotype and involve artificial insemination and supplementary feeds in addition to grazing and stall-fed roughage. These farmers, on average, own five dairy cows. The primary outlet for milk is either the DDE or local informal markets.

Intra-urban dairy farms in Addis Ababa: These dairy farms are specialised and intensive production units based on zero grazing of cross-bred and high grade cows. There is little or no grazing within the city and stall-feeding is based on purchased hay and concentrates. The level of exotic blood in the herd is among the highest found in the sample. Annual milk production per cow is high and the milk is directly sold at the local markets.

Urban dairy in secondary towns: These are specialised dairy farms found in most secondary towns within the milk shed. In these small towns, farmers have more access to grazing; stall-feeding is therefore less intensive. The level of exotic blood in the herd is high, but the herd size is the smallest of all the categories and averages about two cows per farm. Milk is sold fresh to local markets or the DDE, or processed into butter and *ayib* and sold. Most farm owners have off-farm activities representing about two-thirds of their income.

This detailed study conducted on three production sub-systems showed that 76 percent, 22 percent and 54 percent of the farms in secondary towns, peri-urban and intra-urban areas respectively are owned by female farmers. The percentage of illiterate farmers (owners) was highest in intra-urban (50 percent) farms followed by those in secondary town (37.5 percent) and peri-urban (12.5 percent) areas.

Conserved hay, agro-industrial by-products and commercial concentrates are the major feed resources used by urban and peri-urban dairy farmers. Hay makes up almost the entire basal diet of cattle on peri-urban dairy farms. Agro-industrial by-products are fed as supplements to roughage-based diets, and are mainly accessed by peri-urban dairy production systems, due to the fact that most of the by-product processing industries are located around cities and towns where the demand for the major products is high. The use of commercial concentrates is restricted to institutional farms and certain large peri-urban dairy farms. Non-conventional feed resources such husks of pulses and other crops, residues of traditional breweries, poultry waste, vegetable and fruit wastes (Yoseph Mekasha, 1999) are cheaper and play a significant role in peri-urban dairy production systems.

Cross-bred and grade animals are preferred by 85 percent, 67 percent and 44 percent of farmers, while pure temperate breeds are preferred by 10 percent, 33 percent and 56 percent of farmers in secondary towns, peri-urban and urban areas, respectively. Among the temperate dairy breeds, the Friesian is the most preferred. About 92 percent of urban farmers increase their herds through crossbreeding zebu cows with exotic bulls. Purchasing of heifers or cows from other dairy farms is the main source for 29 percent of the farmers in secondary towns and 17 percent in peri-urban areas. The criteria for selection of animals vary. Milk yield potential, reproductive efficiency, disease resistance, breed or size are the most important criteria for bull selection.

Cash income from the sale of milk and/or breeding animals and utilisation of available resources (land, feed, labour, capital) are the most important reasons for keeping dairy animals in urban and peri-urban dairy production systems.

Production, constraints and opportunities for development

Azage Tegegne

A well managed medium sized dairy farm around Addis Ababa

Market-oriented urban and peri-urban dairy production systems are emerging as important components of the overall milk production system in Ethiopia. These systems are contributing immensely towards filling the large demand-supply gap for milk and milk products in urban centres, where consumption of milk and milk products is remarkably high.

A survey undertaken by the Addis Ababa Agricultural Bureau shows that there are a total of 5,167 small, medium and large dairy farms in and around Addis Ababa city. The total milk production from these dairy farms amounts to 34,649,450 litres per annum. Of this, 73 percent is sold, 10 percent is left for household consumption, 9.4 percent goes to calves and 7.6 percent is processed mainly into butter and *ayib* (Azage Tegegne and Alemu Gebrewold, 1998). The total amount of milk available to Addis Ababa is 43,849,675 litres per annum.

The large demand for milk on the one hand and the small supply of milk and milk products for the major urban centres in Ethiopia on the other hand shows the untapped potential for the development of urban and peri-urban dairy farms. Market-oriented smallholder peri-urban dairy production systems have a tremendous potential for development and could play a significant role in minimising the acute shortage of dairy products in urban centres. Current increases in economic pressure, competition for limited resources and market forces have led to an increase in the level of intensification in these production systems.

In order to sustain high productivity and profitability, high levels of management in appropriate feeding, health care, and reproductive activities are essential. These urban and peri-urban dairy farms are currently facing new challenges associated with intensive production systems. Availability of land, management skills, labour force, feed and water resources and feeding systems, genetic improvement, control of diseases and parasites, udder health and mastitis, calf mortality, reproductive problems, waste management, quality control, public health, processing and marketing and other socio-economic considerations are becoming important factors influencing and determining the survival of these production systems.

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Grazing Animals as Park Managers? Using animals in the management of urban green areas

Inger Ledin
Anna Jonasson

Interest in using grazing animals in the management of parks and other urban green areas has grown in Sweden in recent years. Through grazing and trampling these animals create the conditions for a rich flora and fauna.

This study was undertaken to document the use of grazing animals for management of urban green areas in Swedish municipalities. A questionnaire with 40 questions concerning the activities, organisation, results, public reactions, among others, was sent to the persons responsible for the management of green areas in 49 (of a total of 290) municipalities that use animals in urban areas.

Common Characteristics of Municipalities

Most of the municipalities were in areas with a vegetation period greater than 190 days and consisted of cities or larger towns. In areas where the vegetation period is shorter, the people will probably be less interested in making all the necessary arrangements to keep grazing animals. The same can also be said of rural communities that have small central urban areas and limited park land and that are moreover surrounded by farms with grazing animals. The grazed areas varied to a great degree but most areas were between 0.3 and 5 ha in size. The primary reason for the activities was a desire to keep the land open, but another important motive was to keep or recreate a certain flora, especially valuable trees.

Anna Jonasson

More than 70% of the municipalities in the study used sheep

Choice of Animal Species

More than 70 percent of the municipalities in the study used sheep. Some municipalities used more than one species on the grazed area, eg. sheep and cattle, which often gives a better grazing result. The choice of animal species and breed depends on the properties of the land that is going to be grazed and the desired grazing result. Since the grazing land is in urban areas it is also necessary to consider the affected public. Smaller animals are perceived as less dangerous than big animals, but there are often fewer problems with vagrant dogs and injured animals if cattle and horses are used.

The most common situation was that the animals were privately owned, but in some cases the animals were owned by the municipality or various associations such as riding schools. Using privately-owned animals was in the short term the most economic alternative and experienced people were available and willing to take responsibility for the animals and observe the laws and regulations.

Practical Preparations are Needed

Most municipalities had done some preparatory work before letting the animals in for grazing eg. clearing of shrubs and unwanted trees, sowing of special plants, building of fences around valuable trees, removal of potentially harmful objects (plastic bags or metal pieces) and making an inventory of the vegetation.

The type of fencing used for the areas differed depending on the animal species used and the functional and aesthetic demands. Fences should be efficient and not dangerous for animals or children. From an aesthetic point of view, a fence should not disturb the general view of the landscape and the fence design should be in keeping with the period of history.

Planning Land Management

The written management plans of the municipalities generally contained some background description with the historical aspects, a description of the present character of the area, visions for the future, starting measures, maintenance measures, a time plan, and a plan for evaluation and budgeting. The management measures consisted of recommendations for aspects such as shrub clearing, pasture trimming, species of animals to be used, and whether the use of fertilisers, herbicides or supplementary feeding was allowed. The visions concerned the number of trees in the area and the look and condition of the sward. The result of the grazing was reported to be satisfactory, even better than had been achieved with mechanical management.

Table 12.7 *Comments on Grazing Animals*

Grazing result	The animals	Miscellaneous
Positive comments - Beautiful open landscape. - The grove has returned. - Lots of berries now that the area has been opened up. - The landscape is "alive" in a different way. - More flowers. - A pastoral view of the landscape. - Fewer seeds from weeds found their way into the nearby gardens.	*Positive comments* - Seeing the animals makes me happy. (A frequent comment!) - The animals give variety. - Seeing animals is relaxing. - To be able to meet, caress and maybe feed the animals is a factor of great satisfaction. *Negative comments* - Don't appreciate the animals' dung, especially by the gate. - The animals smell and bleat. - The animals attract flies. - The animals are too close when people want to have a picnic. - The animals break through the fence sometimes. - The animals may cause allergies. - People who are scared of animals are afraid to be in the area.	*Positive comments* - Gets people out into the urban green areas. - Nice place for an outing or a picnic. - Children come into contact with living animals. - Children learn to take responsibility for the animals. - Highly appreciated place for visits for school children and nursery schools. - Combine business with p leasure, teach about animals. - Opportunity to learn about the relation between humans and animals. - Neighbours help each other to look after the animals - creates a feeling of solidarity. *Negative comments* - Not nice with barbed wire. - The fence poles remain during the winter. - Difficult to pass through styles and gates.

Positive public response

Formal evaluations conducted among the neighbours after the grazing season were all positive. Some of the comments expressed are listed in the table below. The positive comments were mainly from neighbours and parents of small children, while the negative comments were made by tourists and senior citizens.

Some problems recorded were vagrant dogs, destroyed fences and molesting of animals. The municipalities that used only sheep or sheep in combination with another species were over-represented among those who had problems.

The majority of the affected public perceived the animals as a very positive aspect; and aside from their effect on the landscape and the environment, the animals had an important social function as well. To get continuous positive responses from the public it is important that the animals are not only well looked after, but also that they are comfortable. Contaminated drinking water or lack of feed or shelter are likely to catch the attention of the neighbours and result in negative reactions.


Anna Jonasson

Seeing the animals makes me happy

To maintain the positive attitude of the public it is also important to consider and improve facilities for other activities in the area. Discussions should be held with, for example, the health office (allergies, manure), the leisure office (tracks for riding, skiing and running), and the building and planning office for suitable locations of gates and openings in the fence. Informative and easily readable signs about the objective of the grazing and the animals will also help to get the support of neighbours in protecting the animals.

Evaluating the Method

It was not considered possible to get the same results with more conventional management methods, and therefore it was not meaningful to put a price tag on the activities. It was concluded that extensive work at considerable costs would have been necessary to achieve at least similar results. The alternative was often no management at all, and even if this method is cheaper than grazing, a value can be put on keeping the area attractive for people.

Practical Implications

It is very clear from the study that the preparations and the way a grazing project is initiated are crucial for its success. This concerns the land, the animals, the owners of the animals and the affected public as well as the vision for the area and the desired grazing result. Careful planning and preparations of all aspects, e.g documents concerning management plans and contracts with the owners of the animals, and a clear idea about what should be achieved, will have a major influence on the success of a grazing project.

The present study relates to the situation in Sweden, however, the positive effects of grazing as a means of managing vegetation can also be obtained elsewhere. Other factors such as availability of animals, ethical opinions on and interest for animals, interest of community officials etc. will determine whether it is possible to use the method successfully. These factors are site specific and have to be looked into on a case by case basis.

Urban Pig Farming in Irregular Settlements in Uruguay

Alain Santandreu
Gustavo Castro
Fernando Ronca

One of the survival strategies developed by the residents of urban settlements in the department of Montevideo, is the collection and sorting of household solid waste (organic and inorganic). While inorganic waste is sorted and sold to the local recycling industry, organic waste is used mostly as animal feed (mainly for pigs). Pig breeders form a distinct group among the urban solid waste sorters and are referred to as sorters-breeders.

Pig Farming in Montevideo

Pig raising is a widespread practice in and around Montevideo. The importance of pig farming in the peripheral areas of the city of Montevideo has increased consistently, particularly since 1970 (Moreira, 1997). Pig farming in the rural areas is permitted and regulated by the Municipality of Montevideo (IMM y OSV, 2003). In the urban areas pig farming is not legal and thus not controlled by the municipality.

Hans Schiere

Small scale pig keeping in Nicaragua

In urban areas, pig farming is mainly concentrated in the so-called slums or *cantegriles*, located in marginal areas and characterised by sub-standard housing and a lack of urban services. Large contingents of labour that the productive system cannot absorb are concentrated in these slums. The sorters-breeders and their families carry out their activities here.

Sorters–Breeders

As the inhabitants of these slum settlements have difficulties in finding jobs, many are forced to develop other strategies for family survival. The most widespread is the collection and sorting of household solid waste. Many sorters divide their time between animal husbandry and other occupations such as street vending or construction work.

Sorting is an economic activity based on the collection of household solid waste (organic and inorganic) which is then sorted and sold to the local recycling industry.
Typically, the sorting is performed by several members of the family who scour the city's middle- and upper-class neighbourhoods, gathering household solid wastes with bicycles or hand- or horse-drawn carts. Sorters who do not raise pigs, feed the organic waste to their horses or discard it along river banks or public roads.

Of the informal waste collectors who roam the streets of Montevideo, 47 percent collect more than 25 tonnes of organic waste per day, which is used to feed approximately 40,000 pigs in urban and peri-urban areas of the city (IMM and OSV, 2003). Sorting inorganic household solid waste is the main activity of the sorters-breeders, while pig raising is a supplementary activity. Studies show that only 8 percent of surveyed sorters consider pig raising as their only source of income, others work in fruit markets (18 percent) and in construction work or receive a pension (both 8 percent). For most sorters–breeders, animals fill the role of a "piggy-bank", which they can access to cope with unforeseen expenses (Vitale et al., 1996; Moreira, 1997; Tommasino et al., 1998).

The process whereby a sorter becomes a breeder can be outlined as follows: a supplier provides a sorter with pigs to fatten up. By selling them the sorter earns extra income, and this motivates him to continue production; gradually, he becomes a sorter-breeder.

Main Features of the Pig Raising System in Urban Squatter Settlements

According to Vitale et al. (1996) most sorters–breeders are small family producers who are responsible for the full cycle which includes not only breeding but also selling of the pigs. Here, a full cycle encompasses the process from birth to fattening prior to slaughtering. More than 67 percent of sorters–breeders involved in this activity have an average of four sows. Others are engaged in raising which refers to the practice of looking after animals from birth until they are weaned from the mother and sold to fatteners, slaughtered, or sold as suckling pigs. Finally, finishers or fatteners only fatten the animals until they are sold for slaughter (Vitale et al., 1996).

In third-party production forms, "capitalists" (term used by sorters–breeders to refer to intermediaries or suppliers) provide the pigs to be fattened. Typically the "capitalist" provides sorters–breeders with pigs weighing between 20 and 50 kg. As this is an illegal activity carried out by the low-income population in marginal areas, the suppliers often lend money or help the breeders to cope with ill health or other problems. This leads to an implicit relationship of fidelity that may hinder the regularisation of this practice.

Wubbo Boiten

Pigs remove waste

Once the pigs enter the squatter settlement, the entire process of raising and eventually slaughtering, processing and selling the meat takes place within the city. Pig farming in squatter settlements implies a significant reuse of household solid waste as feed, although commercial (bakery leftovers, restaurants and fairs) and industrial waste (offal from slaughter houses) are also used. Most settlement breeders buy their animals in Montevideo Metropolitan Area, or in the rural areas around the capital.

The final product sold by the breeders depends on the productive cycle they develop. Thus, breeders sell suckling pigs (both live and slaughtered) to intermediaries, or directly to consumers (only intermediaries sell directly to slaughter houses). Fatteners sell fattened pigs (90-120 kg) to be slaughtered or slaughter the animals themselves. Those who perform the full cycle may sell both suckling pigs and fattened animals. Thus, consumers (who are mainly people from the same settlement) have access to a variety of products (cured or fresh meat) from several sources.

Health and environmental problems caused by pig farming in urban settlements

Pig farming in the city is a survival strategy developed by families, involving all members, and carried out in the place where they live. For this reason, transmission of diseases from animals to humans (see Table 12.8) and the environmental impacts (houses located next to pig sties, inadequate disposal of waste and food preparation systems) of this activity are significant.

Health problems are ranked high on the list of concerns by those who work with sorters-pig breeders. Pig farming is carried out in squatter settlements where overcrowding and lack of services (sewage and potable water) are inherent problems. After all, pig farming is still an illegal activity.

Table 12.8 *Main diseases that humans can catch from pig farming*

Bacterial	Viral	Parasitic	Mycotic
Anthrax (Carbuncle)	Vesicular stomatitis	Trichinosis	Dermatomycosis
Brucellosis		Cysticercosis	
Erysipelosis		Toxoplasmosis	
Leptospyrosis		Sarcotic scab	
Tuberculosis			
Salmonellosis			
Staphilococcia			

Ninety percent of the urban pig breeders use organic waste to feed their pigs: 83 percent of them do not treat the feed in any way. The percentage of sorters–breeders who store food (urban waste) is significant. The only form of treatment is cooking, using part of the waste that cannot be sold to fire the stove (e.g. plastic remains and wood) and causing high levels of environmental pollution. This form of cooking is not adequate to prevent Zoonosis.

Conclusions

Pig farming in urban areas is a significant practice developed within the city of Montevideo. It is a family-type activity that involves children, youth and women continuously. The role of women is highly prominent, both in sorting household waste and in taking care of the pigs.

Although no cost-benefit studies have been undertaken, pig raising in squatter settlements allows households to generate supplementary family income and cope with unforeseen expenses. However, the activity poses serious food safety and health problems, as many sorters-breeders raise and slaughter the animals their compounds without any sanitary control.

In addition the activities of sorters-breeders generate significant adverse environmental impacts due to the sorting and disposal of inorganic and organic solid waste. Much of the waste is just dumped. These problems counteract the benefits arising from the re-use of household solid waste as pig feed and need proper attention.

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The emphasis of this publication is, however, on practical aspects of animal production in urban conditions, such as feeding, breeding and animal species, husbandry techniques, product processing and waste management. The volume is well illustrated with pictures depicting the various aspects mentioned and can be downloaded from http://www.fao.org/DOCREP/004/Y0500E/Y0500E00.htm

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Smith, O.B., and E.A. Olaloku, 1999. IDRC, Dakar, Senegal, ILRI, Addis Ababa, Ethiopia. http://www.idrc.ca/cfp/rep24_e.html
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Meares Cohen, Alison. 1999.In: For hunger-proof cities: sustainable urban food systems / Mustafa Koc, Rod MacRae, Luc JA Mougeot and Jennifer Welsh (eds), p. 90-94. ISBN 0_88936_882_1. CAD 35.00. International Development Research Center (IDRC).
Heifer International promotes a method of participatory development that enables low-income neighbourhood groups to reach beyond the goals of beautification and environmental improvement and become a vehicle for social and economic development in their communities.

Livestock and Wealth Creation, improving the husbandry of animals kept by resource-poor people in developing countries.
Owen, Emyr ; Aichi Kitalyi, Noble Jayasuriya and Tim Smith. (Editor) 2005. Nottingham University Press, DFID and LPP Natural Resources International .
This textbook involves 105 contributors from 26 countries. It discusses the role of livestock and how improved practices can benefit keepers and consumers.

Living with Livestock in Town: urban animal husbandry and human welfare.
Waters-Bayer, Ann. 1995. ETC, Leusden
Small-scale raising of animals by families inside cities is often ignored or even forbidden. However, urban livestock keeping is more widespread than most city authorities admit. It consists mainly of low-input production of poultry, small ruminants, pigs, rabbits, guinea pigs or milk buffalo or cattle, usually indigenous breeds.

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The most serious zoonoses are often viral in origin, and the viruses concerned evolve constantly. While such viruses are generally in a state of equilibrium with respect to their hosts (individual animals or animal populations), this does not hold true for humans, who as a rule are accidental hosts. This special issue of the *Revue Scientifique et Technique de l'Office International des Epizooties* is very interesting from a epidemiological point of view as it documents the risks related to zoonoses at the global level. http://www.oie.int/fr/publicat/rt/copie%20de%20f_rt19_1.htm

Participatory Livestock Research, a Guide
Czech Conroy. 2005. NRI and CTA, ITDG Publishing, UK.
This book offers an introduction to participatory research for livestock development, to both researchers and practitioners.

www.lpp.uk.com
This is the website of DFID's Livestock Production Programme (LPP). The site is divided into sections: "About LPP" gives an overview of the programme; 'Network Forum' provides contacts to people who share an interest in livestock; 'Virtual Library' lists all the research outputs generated by LPP-funded projects, and "Projects Portfolio" is an easy-to-search database with detailed descriptions on LPP-funded projects.

www.fao.org/ag/againfo/home/en/home.html
On the Animal Production and Health Division pages of the FAO website, new developments on research and development issues are reported, with a state-of-the-art assessment of animal diseases. Hosted by the International Livestock Research Institute (ILRI) and the Food and Agriculture Organization of the United Nations (FAO), a group of 25 livestock and futures experts met to discuss the “Future of Livestock in Developing Countries to 2030” and constructed alternative scenarios of likely futures of livestock development in developing countries.

www.heifer.org
This idea of giving families a source of food rather than short-term relief lies at the base of Heifer International’s world-wide activities. Numerous families in 128 countries have received the gifts and in turn passed on the gifts of self-reliance and hope, emphasising l**ong-term solutions** of community involvement and livestock. **“Passing on the gift”** means that recipients agree to share the offspring of animals that are gifted to them with others in need, making them equal partners with Heifer in the fight to end world hunger.

Chapter 13

Urban Aquatic Production

The status of urban aquaculture is assessed in this chapter and the most important literature and knowledge sources are discussed providing a comprehensive overview that highlights challenges facing decision-makers, planners and stakeholders in developing policies, programmes and management strategies that facilitate sustainable, equitable and safe urban aquaculture. The prevailing characteristics of existing urban aquaculture activities are described and the associated benefits are discussed. The recognised constraints and emerging threats to urban aquaculture are then presented. Following this assessment important knowledge gaps and challenges facing planners, managers and other stakeholders are identified and potential approaches to deal with the issues raised are proposed.

Urban Aquatic Production

Stuart Bunting
David Little
William Leschen

Introduction

The cultivation of fish and aquatic vegetables is widespread throughout many cities in South and Southeast Asia and is found to a lesser extent in Africa, Europe, Latin and North America. Despite growing recognition concerning the roles of urban agriculture, including aquatic production, the importance and potential of growing fish and edible aquatic plants in and around cities remains largely unknown. Urban aquatic production is often intrinsically linked with the livelihoods of a significant number of poor people. Urban aquaculture encompasses a broad array of activities, varying from large-scale extensively managed culture-based fisheries like those in the East Kolkata Wetlands to intensive and high-tech production of freshwater and marine fish in tanks. However, in many Asian developing countries, the production systems involved are frequently semi-intensive utilising wastewater directly from the city as a source of nutrients to increase production. The proximity of aquatic farming systems to urban areas presents a number of problems. These may be especially severe if contamination, through urbanisation and industrialisation, of waste resources traditionally exploited to enhance production causes the quality of fish or plants being cultured to deteriorate or negatively affects productivity. Faced with pollution problems, some farmers opt to intensify production depending less on exploiting human waste resources, and more on utilising feedlot livestock waste or inorganic fertilisers and supplementary feeds to enhance production. However, as with intensification in other agricultural sectors, there are risks associated with adopting such an approach. These will be discussed here. Other farmers adopt alternative strategies to mitigate hazards and minimise risks associated with urban aquatic production, but in many cases it seems that the scale and complexity of problems that urban producers face means it is almost impossible for them to address the underlying causes. Foremost amongst these is the sheer rate and scale of physical transformation that characterises many urban centres; much of this change, inevitably alters social and economic as well as physical landscapes. Productive and viable farms may be converted to concrete and tarmac in the course of just a few years. Such dynamic settings can however offer new opportunities for aquatic farming. Limited coordination amongst urban and rural government agencies, weak and ineffective governance, and limited resources mean that urban producers and their problems are often overlooked or ignored. Despite such constraints, urban aquatic production systems provide food and employment, particularly to the poor, whilst there are many other environmental and social benefits that are assessed in the following sections.

William Leschen

Water Mimosa production using waste water in Hanoi

Urban aquaculture is defined here as the practice of aquaculture occurring in urban environments, or areas subject to urbanisation, incorporating by definition peri-urban situations. However, demographic and economic processes giving rise to urbanisation do not occur evenly around urban areas, and many factors influence the rate and extent of urbanisation. Furthermore, urbanisation is not always directly associated with development around pre-existing urban centres. Aquaculture activities (defined in Box 13.1) undertaken in both urban and peri-urban settings share many characteristics. However, we propose that as communities or environments become more urban in nature and the competition with other resource uses develops, then the management of aquaculture must become more intensive, though exceptions and limitations exist. Little and Bunting (2005) provide a more detailed review concerning the basis for development of urban aquaculture.

Box 13.1 *Aquaculture defined*

Aquaculture can be broadly defined as the farming or culture of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants where according to FAO (1995) 'farming implies some form of intervention in the rearing process to enhance production, such as the regular stocking, feeding, protection from predators, etc.' The FAO definition also notes that farming 'implies individual or corporate ownership of the stock being cultivated'. However, based on a more practical understanding of the diverse settings in which aquaculture has evolved Beveridge and Little (2002) note that 'if there is intervention to increase yields and/or ownership of stock or controls on access to and benefits accruing from interventions that this should be classed as a form of culture'; this definition encompasses all types of ownership, including that of households, families, communities, co-operatives and governments that all engage in aquaculture activities. This is of particular importance in the context of urban aquaculture where the equitable management of scarce natural resources is often likely to depend upon community-based organisations retaining ownership, or at least the right to exploit aquatic plants and animals cultured using common property resources.

Urban Aquaculture Systems

Considering the range of urban aquaculture systems, this overview covers the most significant and widespread activities, including aquatic plant production. With many urban centres located in coastal areas, it is also important to note that urban aquaculture, although probably dominated by freshwater production, may also include production in brackish water and marine environments. In this review we build on the aquaculture systems typology proposed by Coche (1982) to better characterise the nature of aquaculture occurring in urban areas and to demonstrate that the intensity at which urban aquaculture is managed varies in response to external pressures and incentives for producers. Coche (1982) defined aquaculture production systems as extensive, semi-intensive and intensive. The main characteristics of systems managed at these different intensities are outlined in Table 13.1.

Conventionally, extensive aquaculture is characterised by the dependence of stock on natural food, however, in most urban and peri-urban settings it can be assumed that natural production in water bodies where extensive aquaculture is practised is enhanced indirectly through nutrient-rich runoff and drainage water. Semi-intensive production routinely involves fertiliser applications to enhance natural food production and / or the provision of low-protein supplementary feed; in urban settings waste resources (agricultural and food processing by-products, offal, hotel and restaurant waste) and direct wastewater applications are exploited. Intensively managed systems, whether in rural or urban settings depend on externally sourced inputs of high protein (>20 percent) feed; but in urban areas entrepreneurs have seized upon opportunities to utilise by-products and waste resources to culture high protein feeds such as tubifix worms and fly larvae to supply aquaculture producers.

Practically, however, these distinctions can become blurred. Many peri-urban culture systems benefit from enhanced natural food production as a consequence of nutrient disposal rather than purposeful fertilisation. Furthermore, in contrast to formal semi-intensive sewage-fed aquaculture, production of aquatic vegetables in nutrient-rich water bodies and canals uses sewage-derived nutrients but there is no control over its concentration, as would be the case in the formal system. Nutrient inputs into many systems may be more or less unregulated although the harvest of products such as fish or plants may be highly managed.

Table 13.1 *Characteristics of urban aquaculture systems managed at different intensities*

	Management intensity		
Characteristic	**Extensive**	**Semi-intensive**	**Intensive**
feed source	natural production enhanced indirectly through nutrient rich surface runoff and drainage water	exploitation of waste resources and fertiliser applications to enhance natural production and / or the provision of basic supplementary feed	dependence on externally supplied high-protein feed; which in some cases may have been produced using by-products e.g. tubifix worms, fly larvae
access, ownership and tenure	open access, common property resources	private, cooperatives, leaseholders, community-based management	private, commercial, research and development, vertically integrated
markets	subsistence, local retail markets	subsistence, local and regional wholesale and retail	high value food and ornamental species, regional and export oriented, food products processed to add value
constraints	variable productivity; access may be denied to poorer community members and new entrants; urban sprawl; competition with other user groups; theft and poaching	contamination of waste resources and pollution may inhibit production and affect consumer sentiment; urban sprawl; limited control over environmental perturbations	high capital costs; inherent financial risks; susceptible to disease outbreaks, technical failures, changing market conditions and competition
opportunities	poorer community members may benefit through continued access or cheaper food from low investment systems	where hazards can be minimised, local production of fish and plants from urban systems can contribute to food security, enhanced livelihoods and environmental protection	investment opens up access to new and larger markets; possibility of higher returns from money and resources invested

Extensive urban aquaculture

Extensive aquaculture is practised in a number of urban settings; the most notable approach consists of stocking fish in reservoirs and large urban water bodies, followed by recapture after a period of 1-2 years. Accounts of stocking and harvesting fish from urban reservoirs have come from cities such as Brasilia, Brazil (Starling, 1998); Hanoi, Vietnam (Sy and Vien, 2002) and Wuhan, China (Liu and Cai, 1998). Culture-based fisheries in Donghu Lake, Wuhan, which covers 1,500 ha are dependent on stocking millions of silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) seed, and providing nursery areas in dammed coves, net-barred bays and net cages to ensure fingerlings are only released when they are sufficiently large to avoid predation. Predatory fish are also controlled to help limit mortality, whilst bulk harvesting is undertaken after a year when fish are around 1 kg in weight. Owing to enhanced management, production increased from 180 t in 1971 to 1,840 t in 1995. The manipulation of fish stocks in urban reservoirs, through selective stocking and harvesting, has also been employed to control eutrophication, but with variable success (Starling, 1998).

A serious constraint to aquaculture in urban reservoirs is the multiple uses of such water bodies by various groups, often with conflicting interests. The openness of such systems also makes it difficult for those farming fish to monitor hazards such as possible pollution sources, or to keep an eye on the activities of other users. The use of cages or pens may constitute an opportunity for farmers to secure access to parts of common property resources, but access of this type may be difficult to negotiate and is likely to cause conflicts and possibly disadvantage poorer sections of communities. There is a growing body of literature concerning common property resources, and guidelines and best management practices proposed for aquatic resources may be useful in developing equitable access and management strategies for urban aquaculture (see for example Bromley, 1992). Continuous cropping of fish from eutrophic urban water bodies is probably one of the most productive and beneficial systems accessible to the poor in Asian cities. Mara, Edwards, Clark and Mills (1993) predicted that a yield of 13 t ha per year would be achieved through the continuous stocking and harvesting of tilapia from extensive lagoon systems managed for wastewater aquaculture, which is significantly higher than production levels in most semi-intensively managed traditional pond based-systems.


William Leschen

Harvesting tilapia in a wastewater fed lake in Yen So, Hanoi

Cage culture is practised on a large scale in the Saguling-Cirata-Jatiluhur chain of reservoirs downstream of Bandung, Indonesia (Hart, van Dok and Djuangsih, 2002); estimates suggest some 4,425 fish cages, producing a total of 6,000 tonnes per year of tilapia (*Oreochromis* sp.), are present in the Saguling Reservoir. However, cages and pens are open to the wider environment and as such susceptible to water quality problems. This *de facto* privatisation of the common pool resource inevitably requires capital assets less available to the poor, who can therefore be quickly excluded from production activities.

It is important to note here that urban wastewater, through nutrient enrichment of receiving water-bodies, can enhance production of wild fisheries. However, little work has been done to quantify the extent and significance of this relationship, whilst most attention is given to ensuring that nutrient enrichment in receiving water bodies does not exceed the environmental carrying capacity, degrading the environment and actually harming capture fisheries. Considering the widespread lack of wastewater treatment facilities in many developing countries, it is likely that drainage water from cities in many countries is flowing to rivers, ponds, lakes and rice fields in urban and peri-urban areas, however, little work has been done to document or quantify this, or to assess the costs and benefits of informal wastewater reuse through aquaculture. Moreover, the environmental, animal and public health risks associated with indiscriminate discharges of wastewater to the wider environment and the subsequent capture and consumption of wild aquatic products require consideration (see the Bangkok case study).

Semi-intensive urban aquaculture

Unlike aquaculture in reservoirs and large lakes, pond-based aquaculture offers farmers greater control over management and permits better surveillance, enabling producers to guard against theft, predation and contamination. Recent accounts of semi-intensive pond-based aquaculture in urban settings have been reported for several counties, including Cuba, Ghana and Tanzania (Abban and Cudjoe, 2005; Coto, 2005; Rana, Anyila, Salie, Mahika, Heck and Young, 2005).

Le Thanh Hung

People are involved intensively in morning glory pre-processing

Around Kolkata, West Bengal, India, urban aquaculture is practised in ponds covering an area of approximately 3,500 ha where the majority of production is based on wastewater inputs from canals draining the city. Various historical reasons and government interventions have contributed to the scale and distribution of land holdings in the area. The landowners are commonly absentee landlords and management of the fisheries is largely undertaken by the leaseholders; others are operated by cooperatives and groups of fishermen and a small number are under government control. Recently it was estimated that these urban ponds produce ~18,000 tonnes per year of fish for sale in urban markets, many of which serve poor communities. Bunting, Kundu and Mukherjee (2005) present a detailed account regarding the management of the system and the constraints facing producers (see the Kolkata case study for further information). A similar system has evolved in Thanh Tri District close to Hanoi, Vietnam. Phuong and Tuan (2005) reported that the total area of fish production in peri-urban Hanoi was 3,348 ha with an annual yield of nearly 9,000 t, and that 52 percent of this production was from Thanh Tri district. However, Edwards (2005) noted that owing to land use planning changes outlined by the authorities the fish culture area in Thanh Tri (now Hoang Mai district) was destined to decline and change from traditional semi-intensive systems to intensive or organic farming, with the emphasis on producing high-quality seed and high-value aquaculture species.

Aquatic vegetable production in semi-intensive and intensive systems is widespread and commercially significant around many cities in Southeast Asia. According to Phuong and Tuan (2005) in Hanoi, water spinach (*Ipomoea aquatica*) is produced throughout the year, whilst water mimosa (*Neptunia oleracea*) is cultivated only in the summer (April to August) and water dropwort (*Oenanthe stolonifera*) and water cress (*Rorippa nasturtium-aquaticum*) are produced in the winter (September to March). Most production occurs in flooded fields, some of which were converted from rice production to generate a higher income; water spinach is also cultivated floating on canals within the city. Water mimosa and water spinach production is reported from peri-urban provinces around Bangkok (Yoonpundh, Dulyapurk and Srithong, 2005). Around Ho Chi Minh City, Vietnam, many farmers in Binh Chanh District have combined water mimosa cultivation with fish production in separate ponds; mimosa providing a daily income whilst the fish consume the duckweed that grows alongside the mimosa (Hung and Huy, 2005).

Duckweed (*Lemna* and *Wolffia* spp.) are commonly removed from aquatic vegetable crops in both Vietnam and Thailand for use locally as fish feed. Water spinach is grown in converted rice fields in Thu Duc District utilising wastewater, in some cases water spinach leaves are used to feed cultured fish species such as giant gourami (*Osphronemus gouramy*) and kissing gourami (*Helostoma temmincki*) that can readily digest and benefit from them. The operating costs for aquatic vegetable production may be lower than for fish culture, the risks from environmental perturbations less and the potential returns higher. However, aquatic vegetable production in many areas is threatened by land use change and the environmental, animal and public health impacts of applying large quantities of agrochemicals during production remain to be quantified. Relatively, aquatic vegetables may be more robust for urban aquaculture than fish; the investment costs tend to be lower and the vegetable crops tend to be less sensitive to acute loss from pollution than fish.

Semi-intensively managed ponds are frequently observed in towns and cities throughout Asia. Production from urban aquaculture however is not usually considered separately from rural production in regional or national statistics, and consequently it is difficult to assess its extent and relative importance. The considerable production of freshwater aquatic plants is also not generally acknowledged even in national statistics. Risks, costs and benefits associated with small-scale urban aquaculture are poorly defined and understood and this may prohibit investment of time, money or resources in developing enhanced approaches. Risk assessment in relation to household aquaculture practices in urban settings is required if sustainable practices are to be identified and promoted, and is discussed further on in this chapter.


Ruangvit Yoonpundh

Morning glory is sold in retail markets

Describing semi-intensive aquaculture production in ponds close to Kumasi, Ghana, Agyapong (1999) noted that tilapia (*Oreochromis niloticus*) and catfish (*Heterobranchus* sp.) are farmed in ponds ranging from 12 to 54,000 m^2. Poultry manure is widely used to fertilise ponds and supplementary feeding with maize bran, groundnut husk and paste, leaves and coconut fibre is routine. Production from 94 fish farms in the area has been estimated at about 150 tonnes per year. Aquaculture practices that utilise food processing and agricultural by-products, such as poultry manure, are widespread and diverse, and aquaculture has an important role in recycling organic wastes from industrial and urban activities. For example, in Thailand, by-products from chicken processing plants are used to feed catfish (*Clarias gariepinus* x *Clarias macrocephalus*) grown in urban aquaculture systems stocked at high densities (Little, Kaewpaitoon and Haitook, 1994). Little and Edwards (2003) provide a framework for the interaction between livestock and fish production in peri-urban conditions, as opposed to rural environments.

Integration of aquaculture with wastewater treatment using stabilisation ponds and lagoons is widely advocated and several operational systems have been developed; Mara et al., (1993) describe a rational design approach for lagoon-based wastewater treatment that optimises both wastewater treatment and fish production. Lagoon-based systems have been developed for small municipalities in West Bengal, India (Mara, 1997); design and management approaches for these systems have been derived largely from the traditional urban aquaculture practices close to Kolkata. In Lima, Peru, treated wastewater has been used to produce tilapia and studies have demonstrated that fish cultured in this way are acceptable to consumers and that the proposed approach is economically viable (Moscoso, 2005).

Intensive urban aquaculture

Intensively managed aquaculture operations in urban areas are being developed by entrepreneurs in several countries. Although less land may be required per unit of production for intensive as compared to semi-intensive production units (Bunting, 2001), investment costs associated with establishing intensive systems are comparatively high. The advantage of intensively managed farms is that operators can exert greater control over the operation of the system, better regulating factors such as water quality, feed delivery and stock management. More intensive, less open systems also offer producers greater control over public, animal and environmental health hazards. However, due to high capital and operating costs of intensive systems, in many cases it is only feasible to produce high value products, which are often destined for specialist markets.

In Europe, and North America intensive urban aquaculture systems have been used to produce high value fish such as eel, sea bass, shrimp and tilapia (Browdy and Moss, 2005; Bunting and Little, 2005; Zohar, Tal, Schreier, Steven, Stubblefield and Place, 2005). Often, this is only possible when investment costs are reduced through using redundant buildings or waste heat, for example from power stations, to subsidise operating costs. Further to producing food, examples of urban aquaculture from Europe, North America and other regions demonstrate that the practice is used to produce ornamental species, to create visitor or tourist attractions, or is included as part of social development and educational schemes. In developing countries, intensive urban aquaculture systems do exist, for example, producing ornamental species for regional and export markets, a practice that is being encouraged by the local government around Ho Chi Minh City in response to growing pressure on land resources (Hung and Huy, 2005). Intensive production of catfish has been reported from small areas around Lagos, Nigeria (Rana et al., 2005); in Cuba, the Ministry of the Fishing Industry promotes the concept of 'family aquaculture' which includes intensive fish production in urban systems (Coto, 2005); waste from hotels, cafeterias and factories is used in Bangkok to culture catfish intensively (Little and Bunting, 2005). Other intensively managed farms producing high-value food fish and high-quality seed are destined to emerge in other urban and peri-urban settings in response to market demand, rising land prices and concerns over environmental, animal and public health.

Dynamics

In peri-urban areas, access to larger markets and more consistent and reliable demand, mean that producers are more likely to invest in a wider range of semi-intensive management strategies. The greater availability and concentration of domestic waste, in particular wastewater from urban drainage systems, and by-products from food processing and marketing, mean that producers are also able to exploit such resources, reducing their expenditure on fertilisers and feeds. Apparent subsidies to peri-urban farmers in the form of waste resources offer them a significant advantage over producers with limited access to such production enhancing inputs. In selected examples access to such resources has led to dramatic growth in peri-urban aquaculture and widespread benefits for producers. For example, tilapia seed producers utilising sewage near Ho Chi Minh City have a valuable competitive advantage over other producers in the Mekong Delta, even after including transportation costs (AIT/CAF, 2000). However, despite the benefits of being located close to markets and being able to access waste resources, there are potential constraints associated with undertaking aquaculture in urban areas (which are discussed in the following sections).


Ruangvit Yoonpundh

Morning Glory

The transition from extensive to semi-intensive may be attributed to various factors, of which greater demand from markets combined with improved marketing channels often constitutes an important driver for intensification. Control of resources, more access to production enhancing inputs, for example, waste resources, food processing by-products and credit to purchase additional seed, feed and labour can also stimulate intensification. In urban settings the transition from semi-intensive to intensive production appears to be driven largely by financial considerations and increased competition for resources, in particular land, but also solid organic and wastewater resources, labour, credit and markets. Intensification also appears to offer producers greater control, enabling them to better safeguard and enhance the quality of products, addressing concerns expressed by consumers regarding possible health hazards. Despite the competitive advantage associated with intensification, several barriers to such a transition can be identified; transaction costs may be high, whilst limited access to knowledge, training, credit, markets and institutional support limit the options and opportunities available to producers. Insecure tenure and poorly defined property rights can also mean that producers are unwilling or unable to invest in intensification or improved management approaches.

Benefits of Urban Aquaculture

Employment, income generation and food security constitute important and tangible benefits of urban aquaculture, in particular, for people from poorer communities. However, wider benefits afforded to society such as managed waste reuse leading to improved public and environmental health protection, economic benefits such as increased tax revenue and subsidised waste management, non-renewable resource recovery. Additional functional and non-functional values may also be attributed to urban aquaculture.

Food security and meeting market demand

Reliable and high level demand for aquatic products in urban markets is a primary driving force behind the development of many urban aquaculture activities. Farmers engaged in urban aquaculture have a number of advantages over rural producers, most notably their proximity to markets means that they, or intermediaries, are able to deliver fresh products in a timely fashion to consumers, potentially securing a market premium. Consumers in many Asian countries prefer to buy live fish as a guarantee of freshness, and for urban aquaculture producers it is possible to supply live fish to the market at little extra cost. Increased supplies of aquatic products to markets from urban aquaculture can also help lower the cost of such commodities, thus making them more accessible to poorer communities. Considering aquaculture at the peri-urban interface of cities such as Hanoi and Kolkata, having access to wastewater means that farmers are able to supply fish throughout the year to urban markets. This is important as many of the markets supplied serve poor communities (Morrice, Chowdhury and Little, 1998) and there is a growing recognition (Punch, Bunting and Kundu, 2002) that in some situations urban aquaculture makes a significant contribution to food security in poor households and communities.

Employment and income

Urban aquaculture can provide employment for large numbers of people. Jobs are created directly as a result of stocking, harvesting, maintainance and management, and indirectly in associated activities such as producing and supplying seed and feed, making nets and boats and transporting and marketing harvested products. Estimates suggest that urban aquaculture around Kolkata provided direct employment for 8,000 people, whilst employment in associated sectors servicing the farms was put at over 20,000 people (Kundu, 1994). Employment of one family member, either directly or indirectly, as a result of aquaculture may provide a valuable source of income, but it cannot be assumed that benefits are divided fairly amongst household members (Harrison Stewart, Stirrat and Muir, 1994). Furthermore, where urban aquaculture is practised on family farms, inequality within households may mean the distribution of tasks unfairly burdens particular individuals. As noted in the previous section, many urban aquaculture systems operate throughout the year, and consequently workers employed in such activities are less vulnerable to seasonal labour demands. However, it should be noted that a seasonal demand for additional labour does occur in some situations, and employment for even short periods may constitute an important component in the portfolio of activities that make up poor livelihoods (Punch et al., 2002).

Resource Recovery

Reusing wastewater and by-products from agriculture and food processing in urban aquaculture offers a possible solution to the problem faced by many farmers in developing countries of limited access to nutrient inputs and water resources. Ensuring the maximum possible benefit is derived from appropriated water resources and nutrients contained in both solid and liquid waste will reduce pressure on the remaining renewable freshwater resource and non-renewable mineral resources. This may contribute to reduced conflict over controversial dam building and mining schemes, and limit environmental degradation. Furthermore, compared to prevailing approaches to disposing of wastewater and solid organic waste in many developing countries, productive reuse of waste resources in urban aquaculture offers a greater degree of environmental protection.

Financial returns generated by urban aquaculture, and in particular where wastewater or agricultural and food processing by-products are employed, could potentially subsidise the development and maintenance of formal collection, treatment and delivery strategies for the waste resources. Mara and Cairncross (1989) noted that for Trujillo, Peru, the approach recommended for development of a lagoon-based wastewater treatment facility was to charge construction costs to the municipality and to charge the local farmers who irrigated their crops with treated wastewater with land and operation costs. Responding to a survey, the local farmers indicated that this was an equitable solution, with the cost of treated wastewater expected to be half of what some of them pay for groundwater.

Household and community health and benefits

Urban aquaculture can help facilitate the managed reuse of waste resources and according to Mara and Cairncross (1989) wastewater reuse through aquaculture, which occurs predominantly in urban settings, could be an important component in the sanitation strategies of poor communities in developing countries. Providing sanitation is an important component of development, and is recognised as being of prime importance in improving the general health of the population, reducing infant mortality and the incidence of severely malnourished individuals with associated physical and mental health problems whilst increasing life expectancy (World Bank, 1992; Ahmed, Zeitlin, Beiser, Super and Greshoff, 1993). Inadequate sanitation results in the degradation and contamination of groundwater and surface water. This in turn leads to a need to boil contaminated water, a process that uses large amounts of fuelwood, and results in atmospheric pollution, and possibly increases in respiratory disease (Birley and Lock, 1999). Nutritional and food security benefits associated with urban aquaculture were noted in the previous section.

Distributing benefits from urban aquaculture to the wider community can occur through the presentation of fish to family and friends as gifts; a custom which was observed to be widespread in the town of Saidpur, Bangladesh (Bunting, 2004). Furthermore, by distributing some fish at harvest time to community members residing closest to the ponds, a pond owner found it was possible to reduce the proportion of missing fish. This was attributed in part to either a reduction in poaching by the recipients or greater vigilance of his neighbours reducing the incidence of poaching and predation; enhanced flood control was another factor cited by the owner.

Burbridge (1994) presents a valuable summary of the most important functions attributed to wetlands. These include biomass production, sediment and carbon storage, filtration and cleansing of water, providing pathways or linkages between ecosystems, acting as buffers and regulating the rate of surface-water flow and groundwater recharge within catchments. Preliminary assessment suggests that a similar range of benefits may be attributed to agro-ecosystems supporting urban aquaculture close to cities such as Kolkata, Hanoi, Ho Chi Minh and Phnom Penh (Bunting, 2004; Little and Bunting, 2005).

Management of wastewater and by-products as inputs for urban aquaculture could be regarded as a subsidy provided by the farmers to society, reducing the demand for resources placed on local authorities. Depending on their design and operation, urban and peri-urban fishponds receiving wastewater inputs are likely to facilitate a range of physical, chemical, bio-chemical and biological contaminant removal processes similar to those observed in wetlands and lagoons (Watson, Reed, Kadlec, Knight and Whitehouse, 1989; Mara, 1997). Furthermore, assessments by Breaux, Farber and Day (1995) and Brix (1999) demonstrate that constructed wetlands constitute an ecologically sound and cost-effective means of sanitation, especially when compared with conventional waste treatment and management strategies.

Constraints to Urban Aquaculture

In the case of extensive and semi-intensive urban aquaculture practices, several factors threaten their continued operation and constrain development of more refined management strategies. The main factors implicated are described in the following sections. In contrast, however, there appear to be opportunities for intensively managed operations.

Krishen Rana

Large catfish farmed near Ibadan, Nigeria fetch premium prices in city markets

Urbanisation

Processes of urbanisation, in many cases, constitute the most significant threat to the viability of urban aquaculture. Rural-urban migration continues in many developing countries and migrants looking for employment increase the demand for new settlements and temporary housing, and slums may encroach on agricultural land, but more often become established on embankments, roadsides and derelict land. Conversion of land under for urban aquaculture is related to higher-value residential and industrial developments. Unregulated sprawl at the urban fringe is often seen as an irresistible force, leading to a general reluctance to invest in enhanced management practices and maintaining infrastructure, and generating feelings of insecurity among the inhabitants that have been linked to problems such as vandalism, theft and poaching (Little and Bunting, 2005; Kundu, 1994). Ineffective planning and irregular enforcement of regulations by poorly coordinated and resourced authorities exacerbates the problem.

Labour Migration

Following an investigation of problems affecting the operators of farms in peri-urban Kolkata, Kundu (1994) noted that the loss of labour to more highly paid employment represented a constraint to continued operation. Enhancing benefits derived by the poor from urban aquaculture though increased wages and more secure employment arrangements may contribute to the retention of skilled labourers; an alternative would be to support the more effective transfer of skills to new employees. Where dynamic labour markets exist, with people commonly moving from farming activities to more attractive urban employment, this would create opportunities for under-employed community members and recent migrants.

Competition for markets

When threatened by development during the 1950s, a key argument for retaining a network of ponds and paddy fields in the Salt Lake region to the northeast of Kolkata was its ideal location from which to supply fresh produce to urban markets (Kundu, 1994). With the advent of new roads and increased access to public and private transport, urban markets become accessible to more distant producers. Surveying fish markets in Kolkata, Morrice et al. (1998) noted that the large Indian major carp had mostly been imported from other States, from Uttar Pradesh by truck and from Madras, Orissa, Gujarat and Punjab by train. Market studies from Hanoi and Ho Chi Minh City, Vietnam, have identified an increasing demand for high quality aquatic products from urban consumers, but also note that competition from other producers threatens the market for products from traditional urban aquaculture activities (Hung and Huy, 2005; Phuong and Tuan, 2005).

Changing access patterns for inputs

Inadequate access to wastewater has been identified as a major constraint to continued urban aquaculture in the East Kolkata Wetlands. This situation has arisen due to siltation in the canal network conveying wastewater to the fishponds and the inappropriate management of sluice gates regulating the distribution of wastewater. The priority of the local authorities responsible for urban drainage is to ensure that wastewater is drained effectively and safely from the city, and they are under no obligation to supply the needs of the urban fish farmers. The farmers may find themselves in this position as they do not pay for the waste resource, whilst Kundu (1994) noted that competition between farmers exploiting the wastewater resource could be preventing effective distribution. As a consequence of these problems, the farmers are increasingly employing more manageable, but costly, inorganic fertilisers to sustain production and limit their dependence on unpredictable access to wastewater.

Introduction of a pricing system may be one approach to optimising waste resource use, although care should be taken not to disadvantage poor producers. The potential of developing markets for waste resources in stimulating improved supply channels was highlighted by Furedy, Maclaren and Whitney (1997) who suggested that where traditional waste reuse practices have declined, establishing markets for organic waste may promote separation and collection, increasing the value of this resource to farmers and providing income for those involved in processing. Where formal markets are established, such recognition may in turn demand proper regulation to ensure environmental, animal and public health protection. The use of livestock waste in predominantly fish culture and horticulture areas to the south and east of Bangkok are examples of the networks that develop between producers and users of waste in an environment where communications and infrastructure are well developed (Little and Edwards, 2003).

Contamination

Contamination of surface water resources with domestic and industrial pollution constitutes a widespread threat to urban aquaculture. Biswas and Santra (1998) noted that the heavy metal content of fish purchased from urban and suburban markets in Kolkata was higher than similar products from rural markets. Referring to urban aquaculture in Hanoi, Vietnam, Edwards (1997) noted that water from the Set River is widely used, with water from the To Lich River no longer being suitable owing to industrial pollution. The entire wastewater reuse system in Thanh Tri district was apparently in decline, with the canal network that had fallen into disrepair and rubbish dumped in the canals compounding the problem. Problems of contamination are also reported for the Chinese wastewater aquaculture systems in Han Kou region where accounts suggested that fish produced here smelt and tasted of phenols; grow-out ponds are now used as nurseries for small fish, removing problems of consumer acceptance. Where wastewater or other waste resources are used for urban aquaculture the risks posed by contaminants demand careful assessment and monitoring. Bunting and Little (2003) discuss the implications of this and other potential sources of contamination in urban aquaculture in more detail. Source separation (see also Chapter 9) could provide one practical approach to dealing with growing concern over the contamination of wastewater destined for reuse.

Public health concerns

A number of authors have also described potential health hazards associated with urban aquaculture, and in particular those activities where wastewater reuse is practised (Mara and Cairncross, 1989; Strauss, 1991; Edwards, 1992; Edwards, 2001; Howgate, Bunting, Beveridge and Reilly, 2002). Although several of these reviews make hazards associated with aquaculture explicit, it is much harder to quantify the associated level of risk. For example, the risks associated with products grown using waste resources vary, depending on characteristics of the waste resource, the degree of treatment prior to use, the design and operation of the culture system, husbandry and processing practices, subsequent handling and preparation and susceptibility of the consumer. Reviewing health hazards associated with aquaculture employing wastewater reuse, Mara and Cairncross (1989) identified four groups of people at risk: field workers, crop handlers, local residents and consumers. Bunting (2004) provides a more detailed review of the hazards faced by these different groups, describes factors that influence the degree of risk and outlines potential strategies for mitigation. An emerging threat that requires greater attention is the possible relationship between aquaculture operations, where poultry waste is used as a fertiliser, and the transmission of bird flu to humans (see Box 13.2).

Box 13.2 *Integrated aquaculture and avian flu*

A possible relationship between outbreaks of H5N1 avian flu with poultry waste fed integrated aquaculture systems in Southeast Asia has been suggested. This has serious implications for both small and large-scale integrated fish farming systems in urban and peri-urban areas, particularly those utilising wastes from their own chickens, ducks and geese or bringing in commercial poultry wastes from outside sources. Birdlife International, a British-based organisation with partners in over one hundred countries and territories, recently highlighted the issue on their website and urged governments and relevant agencies to ban the use of untreated poultry faeces as fertiliser and feed in fish farms.

Scholtissek and Naylor (1988) identified a similar hazard earlier in a letter entitled 'Fish farming and influenza pandemics' published in Nature and on the promotion of integrated aquaculture systems in Asia stated that 'the result may well be creation of a considerable potential human health hazard by bringing together the two reservoirs of influenza A viruses, generating risks that have not hitherto been considered in assessment of the health constraints of integrated animal-fish farming'. In integrated systems where poultry and pigs are reared in close proximity there is the possibility of mutation of the virus within pigs into a more virulent strain which can more readily be transmitted from human to human, thus leading to fears of a pandemic. However, as Edwards, Lin, Macintosh, Wee, Little and Innes-Taylor (1988) note in their reply, pigs and poultry have been raised together on farms in Asia and Europe for centuries, and they discussed why the 'co-location of pigs and poultry to supply manure for fish culture is neither prevalent nor likely to become so' noting that most integrated livestock-fish farms combine a single terrestrial species with fish.

A recent newspaper article from Ho Chi Minh City stated that considerable quantities of chicken manure were used as feed for fish in Tri An lake, Dong Nai province and that 'the practice of using chicken excrement to feed fish in southern Vietnam is threatening millions of people with bird flu in Ho Chi Minh City and should be stopped' (Than Nien News, 2005). Despite such reports, evidence concerning the transmission of the virus to humans, mediated by such integrated fish farming has not yet been produced. In this regard there is a clear need for further research that can support the much needed risk assessments concerning the possible role of integrated aquaculture systems as reservoirs for the transmission of the virus, and whether the joint rearing of poultry, pigs or other livestock could lead to the mutation of the virus into a more virulent strain.

Considering the future of urban aquaculture this issue highlights more general food safety concerns regarding how fish and aquatic plants are produced using recycled wastes e.g. wastewater, and the paucity of research that has addressed this issue. The PAPUSSA project is assessing heavy metal levels in aquatic plants and fish raised using wastewater in Phnom Penh and Ha Noi, as well as the biological and chemical water treatment capacity of peri-urban aquaculture systems in Phnom Penh, Ha Noi, Ho Chi Minh City and Bangkok. If peri-urban aquaculture is to be sustained and deliver the potential benefits attributed to it in the future, such concerns will require greater attention and targeted human health and food safety oriented research so that policy makers, city planners, potential investors, entrepreneurs and perhaps most importantly consumers, will have the necessary and pertinent information available to them to feel more reassured.

Despite possible health hazards associated with exploiting waste resources in urban aquaculture, it should be noted that adopting formal waste reuse practices incorporating treatment components and procedures for monitoring product quality represents a significant improvement on unregulated informal waste reuse practices. Pal and Das-Gupta (1992) demonstrated that water samples and organs from fish cultured in conventional rain-fed ponds contained certain pathogenic bacteria at concentrations two orders of magnitude greater than similar samples from fishponds receiving wastewater from Kolkata. However, risks posed by urban aquaculture, especially in systems reusing wastewater, should not be underestimated and those responsible for managing such farms should be provided with knowledge on limiting health risks. Schemes for risk identification and evaluation have been proposed by a number of authors (Blumenthal, Strauss, Mara and Cairncross, 1989; Mara and Cairncross, 1989; Strauss, 1991; Shuval, Lampert and Fattal, 1997), however, the development of appropriate materials and tools for operators and local authorities may assist in implementing such measures.

Nguyen Thi Dieu Phyuong

Fish in retail market in periurban Hanoi

Changing social expectations and perceptions

The changing expectations and perceptions of operators, consumers and society may be responsible for the decline observed in, once productive, urban aquaculture systems. As mentioned previously, migration of skilled and experienced employees represents a possible constraint to the continued operation of traditional systems. Box 1: The decline of the wastewater aquaculture system in the wetlands to the east of Calcutta

However, it is important to acknowledge that the expectations of managers and employees are not limited to financial considerations; socio-cultural factors such as social status and conformity demand consideration (Sen, 1995). As consumers become more aware about the origins of the food they eat and get to know that products are derived from urban farming systems, which might be subject to even low level contamination, possibly from traffic fumes or road run-off, their perceptions may be negatively influenced, possibly restricting acceptability (Little and Bunting, 2005). Alternatively, through intensification permitting greater control and consequently quality assurance, it may be that consumers would be willing to pay a premium for products from intensively managed urban systems, and the proximity of urban aquatic production would also address emerging concerns over 'food miles'.

Management constraints

Constraints to urban aquaculture presented above suggest that producers face a number of problems, many of which are beyond their control, but which have a significant influence on the management strategies employed. When practising extensive aquaculture, producers are often unable to exert control over the prevailing hydrology, whilst farmers managing large water areas for semi-intensive aquaculture may find it difficult to regulate all inflows and discharges. In such circumstances, the openness of the culture system may allow contaminants, predators and diseases to enter and nutrients, food resources and stock to escape. The physical openness of many extensive and semi-intensive systems also means there are risks from airborne pollution, particularly agrochemical spray drift, predators such as fish-eating birds, and theft by poachers. Considering that many constraints to production in extensive and semi-intensive aquaculture systems are beyond the control of the farmer, one potential management strategy to limit the risks posed by such hazards is to restrict the openness of the culture system. However, as both extensive and semi-intensive production activities depend on environmental goods and services to supplement inputs from the farmer, restricting the openness of culture systems requires the farmer to either reduce production or to compensate for the loss by increasing inputs.

Although farmers may wish to enhance or intensify production, insecurity of tenure often constrains innovation and investment, with farmers unwilling to invest in new technologies and management techniques, instead wishing to limit their exposure to financial risks. Limited access to finance can also constrain innovation by those willing to invest; Kundu (1994) noted that farmers around Kolkata were unable to access bank loans as they lacked documentary evidence of ownership and cultivation rights. Furthermore, urban aquaculture producers often have limited access to information, even on fundamental aspects such as disease and pest management and seed quality; therefore, development of enhanced dissemination pathways may be an important component in ensuring that farmers information needs are met.

Challenges for Planners, Policy-makers and Natural Resource Managers

The nature, extent and management of urban aquaculture in various settings have been discussed above, and the most significant benefits and constraints associated with this farming activity have been described. However, from this assessment it is apparent that various gaps exist in the knowledge base relating to urban aquaculture and important areas requiring further consideration are discussed below.

Future direction – diversity in adversity?

Many traditional urban aquaculture systems, in particular extensive and semi-intensive systems, are undergoing rapid change in response to burgeoning urbanisation and industrialisation. Assessing the findings of recent research focused on peri-urban communities in Bangkok, Hanoi, Ho Chi Minh City and Phnom Penh, it is possible to identify some common trends and promising future scenarios which may be relevant outside Asia. Of the sixteen communities studied under PAPUSSA it seems likely that eleven would stop growing fish and aquatic plants within five years (Leschen, Little, Bunting and van Veenhuizen, 2005). The reasons behind this can be summarised as increasing pressure on land for residential and industrial construction and increasing environmental problems caused by industrial and chemical discharges in wastewater leading to declining production. The remaining communities are all located on the periphery of the cities, and some have been included within designated 'agricultural production areas' on official urban development plans, which may provide some security and explain their continued interest and involvement in urban aquaculture.

Within all of the communities studied a number of aquatic producers exhibited risk averse management strategies in response to the dynamic and changing environments in which they live. In Bangkok and Ho Chi Minh City certain fish farmers have gone into the production of ornamental fish species, often developing their systems into more intensive lower land use facilities and frequently utilising treated wastewater. In Ho Chi Minh City some hatchery producers have also started cultivating and selling ornamental house plants. Similar livelihoods diversification strategies were observed in Hanoi where adopting a rotation of aquatic plant species, i.e. morning glory, mimosa, watercress and water dropwort, provided farmers with significantly overall higher incomes and some protection from seasonal price fluctuations. Successful aquatic plant producers in Hanoi have also used their profits, and drawn on other human and social assets, to set up small-scale electro-plating workshops producing kitchen and bathroom utensils, whilst in Phnom Penh many of the women working in the cultivation of morning glory in the wastewater-fed Beung Cheung Ek lake have developed other small businesses, including shops and stalls selling food and household items.

Following a considered assessment of findings from Bangkok, Hanoi, Ho Chi Minh City and Phnom Penh, Leschen et al. (2005) concluded that the disappearance of aquaculture from the livelihood strategies of some urban communities is inevitable due to intensifying urbanisation, a process which also involves the gradual shift of urban aquatic production to more peripheral peri-urban areas. This mirrors experiences from other cities around the world where agricultural production has similarly been displaced. However, displacement should not be equated with absolute loss as many of the communities and locations to where aquaculture is relocated are still considered urban or at least peri-urban in nature.

New and innovative examples of urban aquaculture are emerging, as exemplified by intensive production of catfish in small areas around Lagos, Nigeria, and examples of family aquaculture from Cuba (Coto, 2005; Rana et al., 2005). And it has been proposed here that other intensively managed farms producing high-value food fish and high-quality seed are destined to emerge in other urban and peri-urban settings in response to market demand, rising land prices and concerns over environmental, animal and public health. Unlike many traditional systems in developing countries, these new urban aqua-farming activities will only require a relatively small area and production will be more intensive, based on supplementary feeding as opposed to waste inputs, thereby avoiding problems related to health risks and consumer acceptance. Innovative urban aquaculture operations being developed in North America and elsewhere are also increasingly regarded as multifunctional, producing food, whilst also contributing to social development, education and environmental protection.

Rigg & Salamanca

Fish, people, and transport co-mingle at Hanoi's biggest early morning freshwater fish market in Thanh Tri District

For cities being considered as part of the PAPUSSA study the linkages upon which urban aquaculture depends - access to low-cost by-product and waste inputs and marketing opportunities associated with proximity to the city - remain and continually evolve. Notably, however, in the case of Hanoi the municipal authorities have retained large wetlands and lakes within the city boundaries for aesthetic and flood control reasons, and these remain accessible for aquatic food producers and indeed this is encouraged by the authorities as they believe the residents of Hanoi will equate food production with good environmental health, thus providing reassurance to consumers (Leschen et al., 2005).

The future for growing both aquatic plants and fish using urban wastewater will depend on planners being able to coordinate and develop strategies for the effective separation of industrial waste effluents from domestic sewage. This is desirable from other perspectives too, including other farming groups, such as lower income households who may rely on the cultivation of land vegetables and crops using wastewater as their main, and often only, source of water and nutrients, and in terms of more general environmental protection. However, implementing separation or on-site treatment by industries could prove impractical in larger cities where space may be limited and the costs of modifying existing infrastructure may be prohibitive. However, there are examples from Hanoi, Ho Chi Minh City and Kolkata where the relocation of industries from urban areas to industrial parks and zones should allow the more effective treatment and monitoring of effluents. Smaller provincial cities and towns may be better placed to incorporate aquatic food production in their development plans, but further work would be required to confirm this. There are opportunities for producers to diversify into producing high-value food fish, high-quality seed and ornamental species in intensively managed systems with more controlled environments, but there are financial and technical risks associated with such a strategy.

Stakeholder roles and priorities

Awareness and understanding concerning the roles and priorities of stakeholders, their relationships and associated strengths and weaknesses is an important step when developing planning and management strategies that take into account the demands and expectations of producers, consumers and other community members. The findings from a stakeholder analysis summarised below demonstrate that producers, planners and policymakers have different priorities and agendas.

Results from the PAPUSSA project demonstrated that fish farmers benefited from training and extension more than aquatic plant growers, but both government and non-government organisations remain focused on more commercially oriented aquaculture development in provincial areas. As with plant growers, there was little evidence, except in the case of Bangkok, of group formation or trade associations that might help protect their interests or help in marketing. Fish producers were better represented in urban planning through Fisheries Departments, but still had little influence. Considering local planners and district and commune officials, most local officials had a limited role in providing information and statistics for higher centralised urban policy makers. Overall there is little planned integration of aquaculture with other uses of urban water resources. Centralised planners and policy makers generally lack information about the relative importance and benefits that can be associated with producing fish and aquatic plants in urban environments, or indeed the possible hazards associated with such practices. There has been limited provision for future development or even maintenance of urban fish and aquatic plant cultivation in previous city development plans, but a policy of zoning being implemented in peri-urban Ho Chi Minh City and to a lesser extent around Hanoi does make provision for urban food production, including aquaculture. Priority setting by key stakeholders was largely governed by the most influential government ministries and political and commercial lobbyists.

An interdisciplinary and multi-stakeholder approach is critical in the identification and involvement of the principal stakeholders needed to formulate and implement development plans that can accommodate the continued cultivation of fish and plants in cities (Kundu, Halder, Pal, Saha and Bunting, 2005). Hung and Huy (2005) summarise the findings of a detailed analysis of the institutional linkages and hierarchy within the urban planning and policy process relating to aquatic production systems in Ho Chi Minh City. They note that though the urban authorities have designated some areas for agriculture and aquaculture, areas used for aquaculture outside these zones are undergoing rapid conversion for residential and public construction. Aquaculture rarely has priority in land use planning and often does not feature on the agenda. With limited information on city development plans and the future prospects for urban aquaculture, farmers are reluctant to take risks or invest in aquatic production activities.

Public, animal and environmental health

Public, animal and environmental health hazards constitute some of the most significant challenges to urban aquaculture, though the risks from such hazards are likely to vary depending on site specific variables. Consequently, where urban aquaculture is practised or proposed, work should be undertaken to identify potential problems and to develop management strategies that minimise risks. The question however of who should be responsible for ensuring such a strategy is implemented may be difficult to answer. Although producers may be well placed to identify possible hazards, in the absence of clear incentives, they are unlikely to take responsibility. Instead local institutions may need to facilitate and support the identification and management of hazards; yet, institutions in many developing countries are unlikely to have the capacity or resources to undertake such a programme.

Where public perceptions of products cultured in urban environments are of concern, such measures may be instrumental in ensuring continued consumer acceptance.

Mario Gonzalez Novo

Feeding fish in small basins with worms

Where generic guidelines have been developed for managing hazards in aquaculture, such as those for Hazard Analysis and Critical Control Point (HACCP) proposed by FAO (1997), it would be desirable to first test their appropriateness for urban aquaculture at the regional or local level. Strategies for managing hazards should also be appropriate for producers, specifically taking into account their access to resources, including finance, labour and knowledge. The development and implementation of a HACCP framework for urban aquaculture could make a significant contribution to improving both the health of workers and food safety. HACCP appears preferable to product monitoring. Although desirable, several limitations have been suggested, constraining development of HACCP for small-scale farmers, therefore, only by working together producers may be able to formulate management plans that minimise risks to the environment, workers, local communities and consumers. Furthermore, given the need to base HACCP on sound scientific principles, it is evident that local government and non-government agencies would have important roles in monitoring, identifying critical control points and assessing the magnitude of the risks posed. Research is currently underway to assess the risks to both consumers and those who work with wastewater and the initial findings have been presented by van der Hoek, Anh, Cam, Vicheth and Dalsgaard (2005). A water sampling programme has also been established for inlets and outlets of different peri-urban wastewater-fed fish and aquatic plant systems in Hanoi and the results will provide indications of the potential of these systems for facilitating the cost-effective treatment of wastewater.

Knowledge gaps and critical issues

Problems in accessing information, new knowledge and credit (see Chapter 4) suggest that local government institutions, community-based organisations and non-government organisations have roles to play in providing such services. However, the selection and development of appropriate extension materials and pathways and the formulation of suitable credit arrangements is likely to demand resources and require a participatory working style. This in turn may first demand capacity development within local institutions. However, there is often the question of who is responsible for urban aquaculture, for providing support and technical advice, ensuring product safety and informing consumers and others about such activities. Furthermore, in many cases, the question also is whether urban aquaculture is an activity meriting support from local, national and international organisations.

Despite the apparent importance of this activity in certain situations, in providing employment, producing food or contributing to environmental protection and resource recovery, there is no clear picture of the overall extent of the activity or contribution of products from urban aquaculture to regional or national food supplies. To understand the situation better it would be necessary for institutions that collect and collate aquaculture production data to delineate between production in urban settings and that in rural areas. However, such a distinction may be difficult to make, especially where urban aquaculture is not defined in solely geographical terms.

Ellis and Sumberg (1998) noted that 'the significance of food production in and around towns for the overall quality of life in developing counties should not be exaggerated'. Although urban aquaculture may be important to local communities, contributing to employment and food security, it may only play a minor role at a regional scale. Therefore, institutions, especially urban authorities with limited resources subject to varied demands, need to assess rationally the net benefit for poor communities from helping sustain or supporting the development of urban aquaculture. Such an assessment should involve a broad-based socio-economic analysis, however, some factors may be difficult to quantify, whilst others may receive a disproportionate weighting depending on the agenda and priorities of those involved; relative merits of competing activities will also require assessment. Clearly the multipurpose roles of urban water bodies, for flood control, amenity uses, wildlife, and broader environmental benefits must be considered in any holistic plan that includes the promotion of aquatic food production.

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Aquatic Food Production Systems in Bangkok

Ruangvit Yoonpundh
Varunthat Dulyapurk
Chumpol Srithong

Around 10 million people now reside in densely populated communities within Bangkok. As a result, the demand for food has increased drastically. Of the many varieties of fresh produce available, the city consumers favour aquatic products such as morning glory, water mimosa and freshwater fish. These products are grown primarily in periurban areas around Bangkok.

Ruangvit Yoonpundh

Morning Glory farming on the outskirts of Bangkok

Aquatic production systems, including farming of edible aquatic plants and fish, play an important role in the livelihoods of many urban dwellers employed as farmers and vendors. Production from inland aquaculture increased to around 280,000 metric tons in 2002, accounting for nearly 10 percent of the total annual fish production in Thailand (Department of Fisheries, 2004). This generates an income of nearly 10,000 million Baht (US$ 250 million) a year. Around 30 percent of this intensive aquatic production is concentrated around Bangkok's periurban areas. For example, in the northern part of Bangkok in particular, hybrid catfish farms produce more than 70 percent of the country's total production of catfish (around 80,000 tons) and extensive water mimosa farming in public canals is found in Pathumthani province. In Nontaburi province, about 40 kilometres west of Bangkok, there are vast areas of intensive morning glory farms. About 20 kilometres south of Bangkok, mixed tilapia and carp polyculture in large ponds and intensive water mimosa farming is common. However, recent changes in water and land use in periurban areas, made to accommodate rapid expansions of housing projects, industrial factories and the construction of a new airport, have seriously impacted some aquatic production communities, forcing them to change their traditional way of life. Agriculture-based communities are thus being moved into urban and industrialised districts and suburbs of the city.

Deterioration of the aquatic environment resulting from these expansions is an important factor directly affecting aquatic production systems. Although the 9th (2002-2006) National Economic and Social Development Plan (NESD) places priority on decentralisation, aiming to increase control at community level in order to utilise local resources more effectively and sustainably, limitations in the readiness and capacity of these communities have hampered implementation of these plans. Capacity building should include all stakeholders, eg., farmers, extension officers, vendors and policy makers.

In a recent State of the System (SOS) workshop held with a variety of stakeholders in Bangkok it was revealed that the main problems faced by farmers were lack of land and land ownership, high costs of investment and wastewater from communities, factories and village estates (especially during the dry season due to lack of drainage and treatment systems as well as a low sense of personal responsibility towards the public environment). These problems force farmers to increase the intensity of their farming activities and systems in order to increase yields. Intensive farming, particularly in aquatic plant cultivation, uses large amounts of chemical fertilisers and pesticides. Morning glory and water mimosa farmers still lack sufficient knowledge and understanding of chemical use due to their low educational backgrounds and the insufficient number of extension officers available to service all of the farmers. Extension officers are also constrained by their own limited knowledge and time to assist with field work. These problems are compounded by a lack of effective mechanisms for the dissemination of information on chemical toxicity and ineffective laws or regulations on the use of chemicals.

In terms of fish culture, periurban fish farms produce mostly common commercial species such as hybrid catfish, tilapia and carps, which are sold mostly fresh, except for hybrid catfish, which are sold live to markets in Bangkok. Because of high competition and an inadequate marketing system, fish prices are considered low. This means that fish farmers are constantly having to reduce their production costs by using canteen waste and slaughterhouse by-products, which are available locally as fish feed. As a result, water quality in ponds can deteriorate and the water discharged from these ponds can degrade the water quality of local public irrigation canals.

Most aquatic plants and fish produced in the periurban areas are transported to Bangkok's retail markets for trading. The most common Bangkok market system relies on the role of middlemen. The first middleman collects all the aquatic products from a farmer, transports these products and sells them to wholesale markets in both suburban and periurban areas. Then another middleman buys these aquatic products from the wholesale markets and sells them through retail markets in the Bangkok area. In an another common Bangkok market system the producer or farmer himself delivers his products to wholesale markets. This type is predominant for aquatic plant production but uncommon for freshwater fish.


Ruangvit Yoonpundh

Harvesting Morning Glory

Expansion of the "modern-trade" type market or "supermarket" in suburban and periurban areas of Bangkok in the past five years, along with the Thai government's policy of "food safety" awareness, has resulted in rising consumer demand for cleaner and better-quality products, such as vegetables free from pesticides that are subjected to food safety standards including packaging and certified quality. In the near future, it is likely that food safety concerns and requests for certification will become increasingly common among consumers and buyers, and these demands will influence the production of aquatic vegetables such as morning glory and of freshwater fish such as cultured red tilapia.

The market system can promote all types of such "food safety" labelled foods by demanding better quality standards and charging higher prices (due to higher production costs incurred in forcing farmers to produce just what the buyer or customer wants). However, aquatic products that meet this standard still account for only a small portion of the total range of products sold in the market. Therefore, in order to achieve sustained growth for aquatic products in these changing markets, it will be necessary to place higher priority in the near future on food safety for all aquatic foods, which includes a safe and clean production process.

The government should gain more understanding of how to sustain aquatic production systems in Bangkok's periurban areas as they are an important source of aquatic foods and employment for the local economy. Increased coordination between relevant stakeholders is also important. In addition to these requirements, studies must be undertaken to develop new technologies for wastewater treatment, improved marketing mechanisms and Good Aquaculture Practice (GAP) for green products. Organisation and policy analysis is also needed to cope with current changes.

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The Use of Treated Sewage Water from Settlement Ponds in San Juan, Lima

Julio Moscoso

The "Treatment and Use of Sewage Water" programme started twenty years ago at CEPIS in order to contribute to increasing the sewage water treatment network in the region using technologies that would allow for the removal of pathogenic organisms as well as organic materials. So far, CEPIS together with several other Peruvian institutions have carried out a series of experiments on the treatment and use of sewage water at the Bio-Ecological Complex in San Juan, south of Lima, Peru.

The research and development project entitled "Aquaculture with treated sewage water in the San Juan settlement ponds" is one of the most important contributions of these institutions. The objective of the project was to treat sewage water in the settlement ponds until it reached a quality appropriate for fish culture.

Julio Moscoso

Harvesting Tilapia in the ponds

The research showed the efficiency of settlement ponds in removing parasites (helminth eggs and protozoan cysts), viruses and pathogenic bacteria, including *Vibrio cholerae.* The settlement ponds in San Juan have the potential to reduce the level of faecal coliforms by 5 logarithms (a factor 10.000) and attain an effluent with 10,000 MNP/100 ml levels. Because the fish ponds were independent systems the concentration of faecal coliforms was reduced to the level recommended by the WHO (100 MPN*/100 ml) for fish culture. No other conventional system can compete with this efficiency in the removal of pathogens, unless the process of effluent disinfection is refined, which would increase costs and make the process and its overall maintenance more complex.

Aquaculture Trials

Some of the preliminary experimental trials in the quaternary settlement ponds were quite satisfactory for the culture of the Nile tilapia (Oreochromis niloticus) and the common carp (Cyprinus carpio), but not for the giant freshwater prawn (Macrobrachium rosembergii). The tilapia is the most resilient and best accepted by the local population, and therefore this was the species selected for our research.

These preliminary trials further demonstrated the impracticality of using settlement ponds for fish culture because such ponds need to be totally drained for harvesting the fisht, thus temporarily stopping the treatment system. Also, the high levels of mud and sedimentation normally produced in the settlement ponds made it difficult to collect the fish at harvest time. Finally it was observed that the frequent fluctuations in water flow were affecting the environmental quality, which directly affected the fish growth and even caused some mortality. It was therefore recommended that the construction and thus the design of the ponds especially for tilapia culture should make provision for the supply of tertiary effluents from the settlement ponds.

Tilapia Culture in Fish Ponds

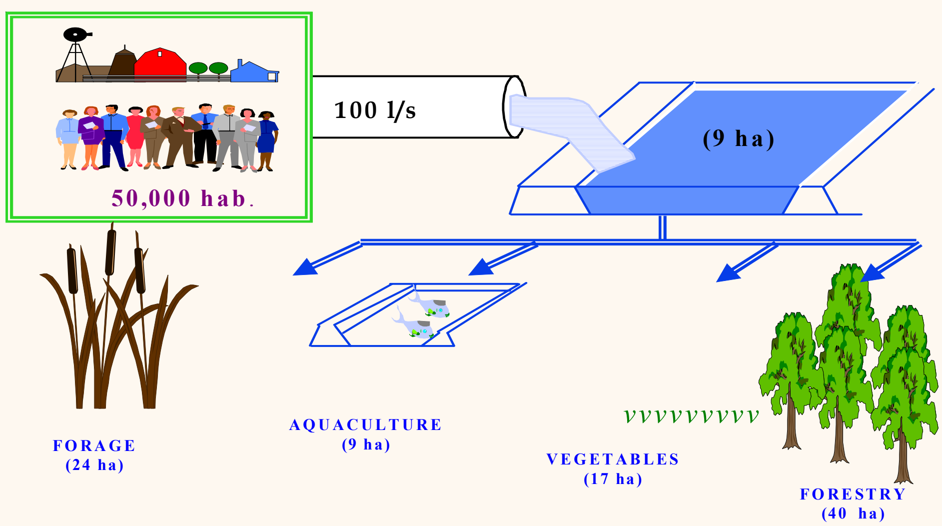
After constructing an experimental aquaculture unit, the second stage of the project was carried out. This was on sewage water treatment in the settlement ponds to guarantee the health and welfare of the cultured fish in the fish ponds. This effluent, which is rich in nutrients, made the algae blooms (phytoplankton) that were the primary natural food source for the fish.

100 percent of the fish from three out of four experimental cultures were qualified as "very good". In only one experiment, 6 percent of the fish were rejected due to an increase in faecal coliforms (which went over the 100,000 MPN[1]/100 ml level) in the effluent that fed the fish ponds. This allowed us to propose 100,000 MPN/100 ml as the health quality standard limit for the effluent used for tilapia culture. It was also observed that tilapia has a great capacity for self-filtering as long as the level of faecal coliforms is reduced for a minimum period of 30 days.

In the subtropical climate of Lima, the growth of Nile tilapia during the warmer months is satisfactory and similar to the rate obtained in tropical climates. A sex-reversed tilapia with an initial weight of 60g can be cultured during the four months of warm weather to reach a commercially-acceptable size of 250g and above, at a density of 2 fish/m^2. The fish ponds' maximum productivity during the summer season is higher than 30 kg/ha/day, obtained from the initial biomass of 960 kg/ha. The maximum stocking density has been set to 4,400 kg/ha, obtained exclusively with the natural feed produced by the fish ponds and with the water supplied from the settlement ponds. The high production of algae, between 700 to 1600 mg of chlorophyla per litre, demonstrated that the addition of artificial feed complements would not increase the fish biomass. Elimination of this step can reduce production costs by up to 70% and allowed us to produce for US $0.48/kg. In tropical areas it has been estimated that similar systems could be carried out continuously and produce three crops of tilapia a year, tripling the annual productivity per hectare and lowering the production costs even more.

The aquaculture project's initial results were used to elaborate a virtual model to expand commercial farms to sub-tropical and tropical regions. This model also enables economic evaluation and a sensibility analysis to study the profitability variation at different land prices, water treatments and product prices. A new version of the model incorporates the use of sewage water in other farming and forestry activities (see figure 13.1).

Figure 13.1 *Settlement ponds in Lima*



These products allow CEPIS to promote the use of appropriate technologies in the treatment and use of domestic sewage water throughout the Latin American region, using a training programme that includes workshop courses and technical cooperation with different Latin American and Caribbean countries. All these materials are available at the Sewage Water web-page, which is part of the Virtual Library on the Environmental Health web site (www.cepis.ops-oms.org).

The integrated system of treatment and use of sewage water is a sustainable and viable way to improve living standards in cities. It enables the adequate management of domestic sewage water, which is the main cause of aquatic environmental contamination and the spread and proliferation of intestinal and parasitic illnesses in developing countries.

Planning for Aquatic Production in East Kolkata Wetlands

Nitai Kundu
Mousumi Pal
Stuart Bunting
Nina Halder
Sharmistha Saha

Wastewater aquaculture, as practised in the East Kolkata Wetlands (EKW), has attracted much international attention as a model system for the reuse of urban wastewater and resource recovery. At present the multi-functional wetland ecosystem covers approximately 12,500 ha, and is comprised mainly of 254 fisheries managed for wastewater aquaculture, agricultural land, horticultural plots and residential areas. It constitutes a unique system of resource recovery, in which nutrients are extracted from the city's wastewater through fish farming and agriculture.

In EKW wastewater flows through fish ponds covering about 4,000 ha and these ponds facilitate a wide range of physical, biological and chemical processes which help improve the quality of the water. Consequently this wetland system is popularly known as the kidney of the city and has been described as one of the rare examples of environmental protection and development management in which a complex ecological process has been adopted by the local farmers for mastering the resource recovery activities. The wetland also supports the livelihoods of around 60,000 residents through the fisheries and other socio-economic activities. The existing land-use pattern of the East Kolkata Wetlands (EKW) is summarised in Table 13.2.

I.de Borhegyi, FAO

Carp raised in aquaculture pond

Table 13.2 *Land use in the East Kolkata Wetlands*

Land use	Area
Water bodies	5,852 ha (about 3,899 ha used for fish farming)
Agricultural land	4,960 ha
Garbage farming	603 ha
Rural settlement	1,235 ha
Urban settlement	91.5 ha
Total area	12,500 ha

In August 2002, the EKW area was included in the list maintained by the Ramsar Bureau established under Article 8 (site no.1208) of the Ramsar Convention, which recognises the EKW as a "Wetland of International Importance". The Ramsar Convention plays a vital role by providing certain basic guidelines to draw up suitable plans for the maintenance and sustenance of the wetlands. Among these, the three most important guiding principles are: maintenance of the special characteristics of the ecosystem, wise use of its resources with an eye towards sustainability and economic development for the wetland community.

The major forms of cultivation prevalent in the region are sewage-fed agriculture, garbage farming and sewage-fed aquaculture. In rural areas, paddy farming dominates production whilst potatoes and other vegetables are cultivated using traditional methods. These farming systems are central to the livelihoods of many local poor people.

Fish cultivation in Kolkata's sewage-fed fisheries is a unique feature. There are more than 154 big fisheries or *bheries* as they are known locally, although fish culture is also practised in numerous small ponds or *jhils* spread throughout the region. The most important function performed by these wetlands is to recover nutrients from a major proportion of the 1,300 million litres of wastewater discharged from the city daily. The total area of sewage-fed fisheries is around 3,900 ha, privately owned *bheris* account for 93 percent of this area, farms managed by co-operatives cover 6 percent and ponds managed by the State Government account for less than 1 percent. Large areas of the fisheries are taken on lease and operated by commercial producers, however, several fisheries became cooperatives, either registered or non-registered, because of the inability of the owners to sustain their fishing activities. The fisheries range in size from over 50 ha down to around 5 ha. Various sewage canals supply water to these fisheries, and the water enters the fisheries either via gravity, siphoning or pumping.

Marketing of fish originating from the wetlands has been studied, and almost without exception the total production is sold through wholesale markets at Bantala, Bamanghata, Choubaga and Chingrighata located in the wetlands. From these four major sources fish is distributed to retail markets scattered throughout the core of the city, but there is also evidence that fish is increasingly being marketed in provincial towns.

Peter Edwards

A pilot duckweed-based wastewater treatment system in Khulna, Bangladesh

Recent field surveys showed that 8,500 people are directly engaged in sewage-fed fisheries, of which about 90 percent are from local villages falling within the EKW, the others mainly coming from the adjoining areas of Districts 24-Parganas (North) and 24-Parganas (South), Midnapore and sometimes from neighbouring states. Fish culture presents opportunities for various types of specialised labour, including security services, harvesting work, loading, unloading, packing and distribution of fish, and as a consequence such opportunities often attract migrant labourers from other districts and states. In general, however, traditional economic activities, namely sewage-fed agriculture and fish culture, primarily involve the inhabitants of the EKW. The main stakeholders are the fishermen, farmers, labourers engaged in fish culture and agriculture, night guards and carriers. Furthermore, there are a number of people who stay in the East Kolkata Wetland area and commute to the city for their livelihoods; these people are part and parcel of the system as it has evolved.

A major problem to the EKW is, for example, siltation of the canals and fishponds. Siltation has reduced the quantity of sewage flowing to the fisheries and made many of the fish ponds much shallower; consequently production has reportedly declined. Such problems are compounded by the adverse effect of notable management failures, including a failure to properly maintain the sluice gates and run the pumping system regulating the storm weather flow and the dry weather flow channels of the Kolkata drainage system in line with the requirements of farmers in the area. As a consequence, sewage-fed agriculture is on the verge of collapse. A number of lift irrigation facilities installed on drainage channels which could alleviate some of the problem are also mostly defunct. Furthermore, a major friction point has emerged between the Kolkata Municipal Corporation and Department of Irrigation and Waterways on the one hand, and the inhabitants of the wetlands who earn their livelihood from the cultivation of rice, fish and vegetables on the other. Many farmers have come to depend on using sewage and garbage from the city as a source of water and nutrients, however, the appropriate management of wastewater and solid organic waste originating from the city is vital to maintaining such a system.

While environmentalists advocate the preservation of the wetlands, speculators are exerting increasing pressure for the right to develop areas for residential and industrial purposes. The wetland is bordered by the city of Kolkata to the west, Salt Lake township to the north-west and the new township of Rajarhat to the north-east. The Eastern Metropolitan Bypass also runs along the western side of the wetlands making the area easily accessible. In combination, these factors are making it increasingly difficult to protect the EKW from developers and real estate agents. Public agencies have also shown a tendency to encroach upon the wetland area for various developmental activities such as locating industries, commercial hubs or public utilities. It is increasingly apparent that the existing legal provisions and agencies responsible for implementing them are unable to prevent such encroachment.

Another source of confusion has been the existence of a plethora of agencies among which the control of the wetland has been distributed. They often work at cross-purposes leading to inaction or in many cases the wrong action. The Kolkata Metropolitan Development Authority was given the responsibility to coordinate developmental activities in the KMA area, which includes all municipalities and corporations coming within its jurisdiction under the Town and Country Planning Act 1979. However, only part of the EKW lies within KMA whilst the remainder is under the jurisdiction of the District Planning Organization under the Panchayats. This convergence of rural and urban governance has been far from effective in the preservation and management of the EKW. Both agriculture and fish culture are suffering due to shortages of wastewater. With proper planning and development of water courses and water bodies and proper management of the sewage disposal system, this major constraint could be addressed. But this would only be possible by ensuring the participation of all stakeholder groups in the decision-making process and subsequent supervision of the proposed activities. An improvement plan for the EKW must address the different types of problems related to the various land-use patterns. Such a plan should also explore possible alternative and better uses that might be permitted within the parameters of the Ramsar Convention.

Resources

Urban Aquaculture
Costa-Pierce, B.A., A. Desbonnet, P. Edwards and D. Baker, 2005. New York Sea Grant, Cornell University, USA. CABI Publishing. 277 pages
Urban Aquaculture is at heart an optimistic book, but it deals with some thorny problems, problems that are all too often ignored. Half of the book is devoted to case studies from both developed and developing countries, which are very illustrative, not only on technical issues, but also on the vitally important social and economic dimensions.

Integrated Livestock-fish Farming Systems, Inland Water Resources and Aquaculture
Little, D.C. and P. Edwards, 2003. FAO. ISBN 92-5-105055-4
The various types of aquaculture form a critical component within agricultural and farming systems development that can contribute to the alleviation of food insecurity, malnutrition and poverty through the provision of food of high nutritional value, income and employment generation, decreased risk of production, improved access to water, sustainable resource management and increased farm sustainability. The objective of the publication is to provide an analysis of the evolution and current status of integrated livestock-fish systems in Asia, particularly East and Southeast Asia, as well as to provide a sound technical basis for considering their relevance for the planning of livestock-fish systems in Africa and Latin America.
http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/006/y5098e/y5098e00.htm

UAM no.14: Urban Aquatic Production
This issue of the UA Magazine presents the findings of the PAPUSSA (Periurban Aquatic Production Systems in South-East Asia) project together with a selection of articles on periurban aquaculture from other parts of the world to an audience broader than only those involved in aquaculture. The section on PAPUSSA aims to give an overview of the status and impact of periurban aquatic production systems in four South-East Asian cities, namely Bangkok, Phnom Penh, Ho Chi Minh City and Hanoi.

http://www.ruaf.org/papussa
PAPUSSA is a 3-year collaborative research project between European and Asian partners funded by the European Union. It seeks to better understand the importance and nature of aquatic food production in and around some of the major cities of Southeast Asia.

www.growfish.com.au
Although originating from the Gippsland Aquaculture Industry in Australia, this portal has a wealth of information, including a report of the visit of a Chinese delegation to the Philippines to study urban aquaculture.

http://www.organicity.org/food/urbaqua/
Rob Freudenberg of Columbia University makes a plea for urban aquaculture in the city in order to use abandoned urban areas and create jobs, and thereby make fresh fish available to the urban community.

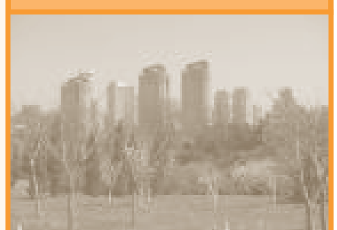
www.cityfarmer.org/fish.html#fish
This site offers several resources on the issue of aquaculture, including a white paper on the status and prospects of New York's Aquaculture by Cornell University. The paper states that indoor food fish aquaculture in a controlled environment has the most potential economic impact, similar to the broiler industry. Tilapia is currently successfully being raised and marketed in upstate NewYork, and accounts for more than 50% of the economic output for finfish production in New York. At **www.cityfarmer.org/fishfarm.html#fishfarm** there is a report by Geoff Wilson of the Urban Agriculture Network - Western Pacific Office **on a** periurban fishfarm near Brisbane, experimenting with native fish and natural foods.

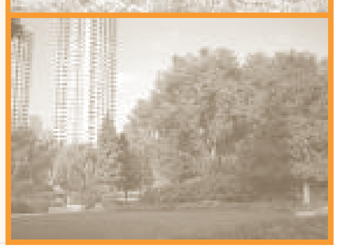
http://www.aquaponics.com/index.htm
This site is a source of information on aquaponics, hydroponics and aquaculture. Aquaponics is the combination of intensive aquaculture (fish farming) and hydroponics (growing plants without soil). The Aquaponics journal can be read at this site, and the discussion board can be used for on-line help and advice on this subject.

Chapter 14

Urban Forestry for Multifunctional Urban Land Use

The contributions of forests, trees and other urban green areas to the quality of urban life and the environment can be significant. When existing good practices are built upon, urban forestry has shown significant contributions to the quality of urban life and the environment, together with other types of comprehensive green-space planning and management concepts. Through agroforestry systems, for example, urban forestry and urban agriculture join forces in supporting livelihoods. A review of the current status of urban forestry research and development, policy-making, implementation and education across the globe shows that advances have indeed been made. Urban forestry has been developed in response to the call for innovative, comprehensive concepts that promote the multiple benefits of urban green space. Sometimes named *urban and peri-urban forestry*, the concept encompasses the planning and management of forests and other tree resources in and close to urban areas and thus integrates different parts of urban green structures.





Urban Forestry for Multifunctional Urban Land Use

Cecil Konijnendijk
Michelle Gauthier

Introduction

World-wide urbanisation brings with it a wide range of challenges. The demand for land increases, and the energy, resource, water and waste disposal needs of urban populations need to be met. Especially in the developing world, where most mega-cities are located and urbanisation is particularly rapid and not necessarily controlled, providing good living conditions to urban populations is one of the main challenges of our time (UN Habitat, 2004). Policymakers are facing tremendous pressures to develop city management strategies that strive for sustainable cities where all inhabitants can enjoy at least a fair quality of life and a reasonably healthy environment.

In the quest for healthy, liveable and sustainable cities, urban green spaces with trees as a major component play an important role. They can help improve livelihoods, temper harsh urban climates, conserve biodiversity, and contribute to better human health. During recent years, integrative and strategic concepts and fields of activity have been developed and implemented across the globe to promote and develop tree-based resources catering to multiple urban demands. Urban forestry is one such promising concept, which in recent years has gained the capacity to cater to a wide range of urban needs and realities.

Cecil Konijnendijk

Forests and trees help to build the city image in a time of increased competition for investment: the city of Dalian, China

Trees and forests for sustainable cities

Challenges related to urbanisation are very significant. Basic concerns such as the provision of food, housing, sanitation and employment have highest priority and are still to be addressed, especially in the developing countries. Urban green space therefore will only be given political priority if it can be used to meet these major urban challenges. Past experience has shown that urban green spaces form more than just a “supplementary” urban infrastructure and can even help provide livelihoods. The goods and services provided by forests and trees in or close to urban centres can be grouped into three main value-based categories.

Economic and livelihood values of urban green

Poverty alleviation and food security are high on the agenda of many international institutions and development aid programmes. With half of the world’s population living in cities and towns, urban agriculture plays an important role in this respect. Many countries have a long tradition of urban dwellers supplementing their diet and/or economy with local agricultural produce (Urban Agriculture Magazine no. 13. 2004). Establishing woodlots in villages and close to urban centres relieves the pressure on natural forests for fuelwood, poles and fodder. Urban forests can enhance urban agricultural production, primarily in agroforestry systems (FAO 2003, Akinbamijo, 2004). Growing trees in combination with other crops or with keeping animals adds value through enhancement of microclimate and other growing conditions and diversification of produce, for example. Timber and other wood products can be very important in urban areas; large parts of the urban population of Africa, for instance, are still heavily dependent upon fuelwood. In times of war and conflict city dwellers have often turned to nearby woodland for illegal cutting of fuelwood, as in the case of Sarajevo in Bosnia and Herzegovina during the 1990s war that split up Yugoslavia (FAO, 2005a). Forests and trees also provide non-wood forest products such as mushrooms, berries, (medicinal) herbs, rattan, seeds, leaves etc. In the industrialised countries, cities have often turned to green areas for providing attractive environments for businesses to settle in and people to live in (Konijnendijk 2003). The generally positive impact of nearby well-managed forests, green areas and trees on real estate prices and business development has been documented during recent years, for instance through hedonic pricing studies (Wolf, 2004; Tyrväinen et al., 2005). Box 14.1 gives examples on how to assess the economic benefits of urban forests.

Environmental and ecological values of urban green

Many of the environmental services provided by urban green space are characterised as climatic or engineering benefits, offering a "green infrastructure" to cities and towns. Of particular importance in both the developed and developing world is the role of forest resources in water management. Many of the world's largest cities rely on fully or partially protected forests in nearby or more remote catchment areas for much of their drinking water. Additional protective measures are often needed to ensure high quality drinking water from these watersheds (Dudley & Stolton, 2004). Quito in Ecuador is one of several Latin American cities that has taken active steps, financially supported by the creation of a water consumption fee, to protect their watershed forests (Echavarria, 2001). In arid regions, forest shelterbelts around cities help combat desertification (FAO ,1999). Trees reduce storm water runoff and can assist with processing wastewater. Urban green also protects soils and moderates harsh urban climates, for example, by cooling the air, reducing wind speeds and giving shade (Tyrväinen et al., 2005). Trees and other vegetation intercept particles and gaseous pollutants and thus help reduce air pollution, as a study of Beijing, China, has shown (Yang et al., 2005). Moreover, forests and trees in cities act as carbon sinks in the equations relevant within the context of global warming (Johnson & Gerhold 2003). The level of biodiversity of urban green areas is often surprisingly high, representing nature and the "wild" close to where people live (Kowarik & Körner 2004, Stewart et al., 2004).


Cecil Konijnendijk

The cultural values of urban and periurban forests should not be neglected: centre of Beijing, China.

Social and cultural values of urban green

The recreational values of forests, parks, gardens and other urban green areas are especially well documented in the Western world. Urban woodland in Europe attracts thousands of recreational visits per hectare per year (Konijnendijk 2003). The large majority of all recreational use of forests takes place in areas not more than 1-2 km from people's homes (Hörnsten 2000). The aesthetic values of trees and green have been known for centuries; urban green space makes for better, more attractive cities. Urban green can have a positive impact on people's physical and mental health by providing settings for physical exercise, reducing ultraviolet radiation and air pollution, and lowering stress levels (eg. Grahn & Stigsdotter 2003). By being actively involved in tree planting and management, local communities can be strengthened and crime rates can be reduced (Kuo 2003). In many developing countries, trees often have cultural and spiritual values that could assist new urban dwellers in finding their place in cities and towns. Today's green spaces and the way they are used and managed can thus have strong historical roots (Forrest and Konijnendijk 2005).

The Concept of Urban Forestry

Natural resource planning and management in highly dynamic urban societies are complex activities. Therefore, concepts and strategies that extend beyond conventional boundaries and involve a wide range of disciplines as well as stakeholders are needed. In the case of forests, tree-based systems and other green resources in and near urban areas, these concepts should recognise the multiple values provided, as well as the role green spaces can play in sustainable development. For the last three decades, the social aspects of forestry have been widely recognised (eg., through social and community forestry), encouraging fair and equitable sharing of forest benefits by the local population, access and use rights, and the participation of civil society in decision-making processes related to the sustainable use of tree and forest resources (Wiersum, 1999). The experience and expertise gained by community-based forest resource conflict management is most relevant for land use and land use change issues in urban environments (FAO, 2002a).

Stella Odurukwe

Urban Agriculture in Dzorwulu next to the power station, Dzorwulu, Nigeria

In line with the dynamics described above, the concept of urban forestry has been developed and implemented as a framework for integrated planning and management of urban (and peri-urban, i.e. adjacent to urban centres) tree resources. The most widely used definition of urban forestry was developed by Miller (1997) who calls it "an integrated, city-wide approach to the planting, care and management of trees in the city to secure multiple environmental and social benefits for urban dwellers". Urban forestry, initially developed in North America, has gradually gained a larger following among scientists and practitioners across the world, although the precise scope and content of the concept remain topics of expert debate (Randrup et al., 2005).

Urban forestry is generally considered to encompass all aspects of establishing, conserving and managing tree systems in or near urban areas. This implies that it also incorporates growing trees as part of agroforestry systems and taking care of individual trees through arboriculture[1]. The areas of intervention of urban forestry in relation to the green structure and distribution include three areas: form design, functions and policies; technical aspects; and management of both individual trees and urban woodlands see also table 14.1 (Randrup et al. 2005). Traditionally, the forestry sector neglected the urban environment, paying more attention to the rural areas. Nowadays, the sector tends to include more comprehensively the concept of "trees outside forests" (FAO 2001, FAO & CIRAD 2002), with an improved approach to landscape management, agroforestry and urban forestry. From the perspective of the Food and Agricultural Organization of the United Nations (FAO), urban and peri-urban forestry considers tree-based systems at large in or adjacent to urban areas (Kotka III 1996; FAO & CIRAD, 2002).

Box 14. 1 *Economics of urban forestry*

Kathleen L. Wolf, University of Washington, Seattle, USA
(*This box is taken from an article by the same author. The full version of the article appeared in UAM no.13, 2005*)

Economics and Public Value of Urban Forests

Active management of the urban forest entails costs of planting, maintenance, materials and disposal. These investment costs are readily tallied and accounted for in budgets of municipal agencies or user groups. Returns on investment are less easily calculated. Many "products" of urban forests are public goods. Multiple "owners" invest in a city's natural capital, generating "products" in the form of intangible functions and benefits for each resident, visitor and user. The experience of these benefits by any single person does not exclude others from experiencing similar benefits, both immediately and indefinitely. In addition, use or experience of benefits by one person or many people does not diminish the encounters of others, which is considered a non-rival situation by economists (Daly and Farley 2004).

Economic valuation approaches

Economic valuation translates urban forest services and functions into terms that enhance public value. Valuation studies have addressed many facets of urban forest benefits:

- Use value – Goods that are harvested from green space (such as food or fuel) may have market value, or substitute for market goods. Urban agroforestry practices can produce human and animal foods and medicinal materials, thus contributing to urban food security.
- Environmental services – Natural areas and ecosystems provide services to society and the costs of creating such services using built systems are deferred. Based on assessing urban forest canopy cover and modelling of air pollution, storm water mitigation and energy impacts, the annual values of urban forest services have been estimated. The Urban Ecosystem Analysis of the Washington, D.C., metropolitan area concluded that tree cover had reduced storm water storage costs by US$ 4.7 billion and generated annual air quality savings of US$ 49.8 million.
- Hedonic pricing – The value of an amenity is determined as an increment of purchase price. Numerous studies have concluded that a quality forest or green space has a positive economic ripple effect on nearby properties (eg., Crompton 2001). Appraised property values of homes that are adjacent to parks and open spaces are typically about 8 to 20 percent higher than those of comparable properties elsewhere.
- Travel cost method – This method calculates the costs that people are willing to add to a trip to experience a desirable amenity or landscape.
- Contingent valuation – The willingness to pay for an actual or hypothetical change in environment, lifestyle, or landscape condition is stated by consumers, often in surveys. Studies on how trees affect shoppers' behaviour in retail business districts have shown that consumers claim willingness to pay about 9 to 12 percent more for products in downtown shopping areas with trees, versus in comparable districts without trees.
- Externalities estimation – This assesses the costs of a negative consequence of a landscape condition or change, such as the health costs associated with human inactivity in cities that are not conducive to walking. The presence of trees and "nearby nature" in human communities invites people to be more physically active. Kuo and partners (2003) have found that the presence of trees within high density neighbourhoods lowers levels of fear, contributes to less violent and aggressive behaviour, encourages better neighbourly relationships and coping skills. Hospital patients recover more quickly and require fewer pain-killing medication when they have a view on nature.

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Table 14.1 *The urban-rural tree-forest matrix*
The grey-shaded area represents the domain of urban forestry (based on Randrup et al., 2005).

	Urban and peri-urban			Rural	
	Individual trees		Urban woodlands	Individual trees	Natural and plantation forest
	Street and roadside trees	Trees in parks, private yards, cemeteries, fruit trees, etc.	(forests and other wooded land, eg. natural and plantations, orchards)	Shelterbelts, trees in between lots, 'parkland trees' etc.	
Forms, design, funtions and policies					
Technical aspects (eg. selection of plant material, establishment methods)					
Management aspect					

Box 14.2 *Main principles of the concept urban forestry*

The concept of urban forestry has several main principles, which include:

Urban forestry is integrative and comprehensive
The concept incorporates different green-space elements into a whole (the "Urban Forest") and thus promotes a holistic view (Mock 2004; Pauleit et al., 2005). It aims for more integrated land-use systems, for example by combining forest, agricultural, nature conservation and recreational areas. It builds on the notion that sustainability of tree-based systems is not exclusive to forest resources, but also applies to other systems such as agroforestry systems and lined tree plantings. Integration also occurs in land ownership, closely related to legal or customary rights of access to and use of the land, the trees and their products (tenure aspects).

Urban forestry is strategic
Urban forestry envisions development of long-term policies and plans responding to the needs for tree resources and urbanisation prospects, connecting to different sectors, agendas and programmes, and taking into account the continuous tendencies of expansion and densification of cities (Mock 2004, Ottitsch & Krott, 2005). This is particularly true when poverty, conflicts and natural disasters force the rural population to migrate into cities (UN Habitat, 2004b).

Urban forestry is multisectoral, multidisciplinary and aims to become interdisciplinary
Urban forestry is built on the involvement of experts and practitioners from a wide range of disciplines and professional backgrounds. These do not only include natural resource professionals, but also planners, social scientists, economists, and others. Urban forestry thus operates beyond traditional sectoral and disciplinary boundaries (Miller 1997; Nilsson et al., 2005).

Urban forestry emphasises social inclusiveness
Developing partnerships between different stakeholders is a key element of urban forestry. While respecting local cultures and traditions, the concept emphasises the involvement of different segments of local communities in managing and using tree resources (Mock 2004, Van Herzele et al., 2005). It promotes decentralisation, public participation, transparency and accountability, and fair and equitable sharing of benefits and access to resources. The development of true partnerships often require the establishment of new institutions, for example public-private, or new public institutions that involve multiple layers of government (Jones et al., 2005).

Urban forests are multifunctional
Urban forestry caters to the needs of urban society by providing multiple benefits. These include the various economic and livelihood, environmental and ecological, and socio-cultural goods and services urban forests can offer (Mock 2004, Tyrväinen et al., 2005).

The world's urban forest resources

One of the challenges facing urban forestry is the difficulty to operationalise the concept. This may partly explain why there is very limited information available on the extent of urban forest resources. International, national and even local resource inventories and monitoring of developments are scarce. One important variable is the geographical limit of urban (and peri-urban), which varies from one site to another and in time. Another variable is the type of resources in terms of tree-based and greening systems being considered. For its Forest Resource Assessments (FRAs), FAO defines three main categories, namely "forest and forest land", "other wooded lands" and "trees outside forests" (Kotka III 1996, Kotka IV 2002). These are all found in urban and peri-urban areas and include for example parks, gardens and street trees and agroforestry systems. The FRA's activities and mandate have increased substantially over the two last decades and FAO has been requested to pay more attention to aspects such as non-wood forest products and trees outside forests (see Box 14.3). Consequently, trees outside forests comprise an important area for future assessments as mentioned in the FRA 2000 report (FAO, 2001).

Box 14.3 *Role of Trees Outside Forest (TOF) in urban environment*

Establishing woodlots in villages and near urban centres relieves pressure on natural forests for fuelwood, poles and fodder. In cities, tree planting is stressed for aesthetic and recreational benefits. While urban, peri-urban and roadside planting is promoted in all the countries studied, Tunisia has perhaps been the most active. Initiatives include establishing a green belt around Tunis, creating parks, lining boulevards and motorways, planting coastal esplanades and implementing a national programme for heritage trees.

In Mali, about 22 000 ha of plantations have been established in villages and urban areas since 1986, and there has been additional planting along roadways. Iran has been active as well, with a network of urban and peri-urban planted forests and parks. Often, however, problems arise when irrigation cannot be sustained in the long term because of water shortages. The use of treated wastewater from cities is therefore seen as an opportunity for urban and peri-urban tree planting in several countries.

Source: FAO's State of the World's Forests 2003 (FAO, 2003).

A study by the United States Forest Service (Dwyer et al., 2000) was the first comprehensive national level assessment of urban forest resources. A combination of methods was applied, including satellite imagery, national statistical data and assessments of particular cities or metropolitan areas. Tree canopy cover was used as a more reliable indicator than land use types. The assessment showed, amongst others, that 3.8 billion trees in urban areas cover 27.1 percent of the land, i.e. about 1 percent of the country.

Europe has not seen countrywide or international comparative assessments of urban forest resources so far, in spite of some efforts, especially by the European Environment Agency (Pauleit *et al* 2005). An explorative study by Pauleit et al., (2002) used tree canopy cover as an objective indicator and found municipal canopy cover of selected European cities to range from 1.5 to 62 percent. In some European cases resource data has been compiled on specific elements of the urban forest, such as woodlands within municipal boundaries. From the information available, be it sketchy and hardly comparable, the significance of urban forest resources in Europe does emerge. Urban and peri-urban woodland alone covers several millions of hectares (Konijnendijk 2003).

Urban forest resource information from other parts of the world is even more difficult to obtain. Some of the sparse insights in Asian urban forest resources have been provided by Kuchelmeister (1998), Webb (1999) and Palijon (2004), while more recently an increasing amount of data is also emerging from China (eg. Jim & Liu 2001; Yang et al., 2005). Information on urban forest resources in selected cities of northern and western Africa, Latin America and Central Asian cities have also been documented through case studies (FAO 1999, CIFOR & IDRC, 2003).

Although information on the natural resource base is scattered or incomplete, varies in quality and is not adequately disseminated, it can be concluded that the potential of urban forest resources is under-developed. The status, size and structure of these resources are often significant but vary greatly. Findings also suggest that urban green space is under pressure from other forms of land use in most parts of the world, although recent afforestation in Europe, for example, has led to an increase in urban (forest) resources at local level.

Urban Forestry Policies and Legislation

Urban forestry policies

Lack of awareness about the potential of urban forestry, of information exchange, and of strategic, coordinated action so far means that the full potential of the urban forestry concept remains to be realised. This is particularly the case in the developing world (Konijnendijk et al 2004). FAO has been among the first organisations taking up the challenge of promoting the concept - under the name urban and peri-urban forestry - as a framework for action, with emphasis on the developing countries and countries with economies in transition, and urban forestry's contributions to food security and poverty alleviation. FAO's activities have included a review of existing activities within urban forestry, as well as an identification of needs for further development. It has encouraged partnership and information sharing between localities and countries. With a state of the art assessment and institutional and policy strengthening as a basis, the role of urban forestry thinking in sustainable development could be enhanced and developed. One of FAO´s recent initiatives is an outlook study of urban and peri-urban forestry in countries of West and Central Asia as part of the Forestry Outlook Study for this region (FOWECA, see Box 14.4).

Box 14.4 *Forestry outlook study & urban and peri-urban forestry – The case of West and Central Asia (FOWECA)*

The Forestry Outlook Study for West and Central Asia (FOWECA) is one among a series of regional forestry sector outlook studies initiated by FAO in collaboration with member countries to examine the trends in the development of forests and forestry. The primary objective of FOWECA is to provide a long-term perspective of the development of the forestry sector in the West and Central Asia region in the context of economic, social, institutional and technological changes. Using 2020 as a reference year, FOWECA aims at analysing the trends and driving forces that will shape the sector during the next two decades, and at identifying policies, programmes and investment options that can enhance the sector's contribution to sustainable development.

This outlook study encompasses the following countries: Afghanistan, Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iran, Iraq, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Tajikistan, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, and Yemen. And within this region, the importance to look specifically at the forestry issues in relation to the urbanisation process and the livelihood of urban and peri-urban populations was identified. It is expected that the outlook study, supported by a selection of city case studies and a range of consultation processes, will help enhance the capacities in strategic planning related to forests, develop a long-term vision to realise the full potential of the sector, and create networks among people and institutions responsible for natural resources management in the region in the context of urban and peri-urban forestry.

Source: FAO (2004)

In terms of policy integration, much remains to be done at the global level, in spite of recent developments in, for example, the field of urban agriculture. In the Harare Declaration in Urban and Peri-urban Agriculture in Eastern and Southern Africa (2003), heads of cities and governments have engaged themselves to promote a shared vision of urban and peri-urban agriculture accompanied by concrete policies and instruments. It should be noted, however, that the integration of land issues is not consistently addressed, and that trees and general greening are not even mentioned at times.

At the European Union level of policymaking, attention to urban forests or even urban green space at large has been limited so far, although access to green space is now seen as an important indicator for sustainable cities (Pauleit et al., 2005). At the national level, however, new policies have incorporated the importance of urban forests and/or urban forest elements. Many north-western European countries have issued policies aiming at establishing new forests primarily for providing social and environmental services, and in which urban agglomerations have the highest priority. Accompanying grant schemes thus favour urban settings. Except for Britain and Ireland, comprehensive local urban forestry strategies are even less common. Ottitsch and Krott (2005) mention that it has been problematic to develop true urban forestry policies at city level due to issues such as funding problems, political struggles, and different priorities. Many city administrations face increased pressure by ongoing administrative reform and budget cuts, which often also lead to diminishing resources for green-space management.

In North America, urban forests have become recognised as important elements of national forest and natural resource policies. The development of the Canadian National Forestry Strategy (2003–08) has been a major step for urban forestry in Canada, as a specific section is allocated to the urban forest and public engagement in sustainability (National Forest Strategy Coalition, 2003, see also box 14.5). Urban forestry policies are institutionalised in the United States, where they exist at federal, state and local level, and are accompanied by funding and research programmes (Dwyer et al., 2000).

Box 14.5 *Urban forestry in the Canadian National Forest Strategy (2003-2008)*

Urban Canadians' perception of the forest surrounding towns and cities often shapes their views on the entire forest, whether in their backyard or across the country. The forest in rural areas affects people living in towns and cities because of its contribution to the economy, its environmental functions (for example cleansing groundwater and regulating water flows) and its recreational opportunities. People living in urban areas are increasingly shaping forest policies by their participation in decision making at local regional and national level. The Canadian National Forest Strategy (2003-2008) was developed through an extensive public consultation process and has led to the active engagement of Canadians in sustaining the diversity of forest benefits. Forest Champions are leading and promoting collective implementation of the Strategy's themes, including the one of "urban forest and public engagement in sustainability".

Source: National Forest Strategy Coalition (2003)

Although urban forestry capacities and policies are often insufficiently developed, especially outside North America and (parts of) Europe, some successes have been achieved elsewhere. Singapore, for example, has strongly institutionalised urban green-space planning and management. It has developed a proposal for an island-wide park connector network (Yuen 1997; cf. Palijon, 2004). The Chinese government has recently incorporated the urban forestry concept into its national policies, as seen in afforestation, the establishment of shelterbelts around urban areas, and the awarding of urban greening awards to cities with successful green space development and management practices (eg. Liu et al., 2004). The example of Zimbabwe is rather typical for many (developing) countries. Although urban forestry is hardly recognised in national policies and legislation, municipal by-laws have often been used to safeguard cities' ornamental tree resources (Makonese & Mushamba 2004). Much can be learnt from the few cities, such as Curitiba in Brazil, that have succeeded in developing advanced greening policies (box 14.6).

Box 14.6 *Urban forestry in the city of Curitiba*

Curitiba is known beyond Brazil's national borders for its policies in favour of well-ordered urban development, a sophisticated public transportation system and environmental conservation. Curitiba has thus earned the status of a modern model city in Latin America. For the last 30 years, Curitiba has focused on its urban planning. A master plan for an orderly urban development was implemented in the beginning of 1971. The development of the master plan was supported by the IPPUC ("Research and Urban Planning Institute of Curitiba") and on-going discussions throughout society ("Tomorrow's Curitiba" seminars). Today, the city is moving forward to extend its solutions to the whole metropolitan area through, for example, "zoning and land use" with time lines for execution. A significant part of the population is involved in Curitiba's environmental programmes, with most success booked in the communal planting project "Plantios Comunitários". In this project, people in a given locality plant native (fruit) trees with the support of the Environmental Education Department. When suitable areas are found, the Department contacts local representatives and involves them in the planning process. The areas designated for planting are always public areas, usually steep slopes or riparian zones threatened by erosion or inundation. The people are also provided with information about the tree or shrub species to be planted. These activities are not restricted to the city centre but have an emphasis especially on the periphery of the urban agglomeration.

Source: FAO, (2002b), Spathelf and Nutto (2004)

Urban forestry legislation

Legislation is an important but challenging issue as long-term security of access and use of the resources is a primary condition for promoting tree planting and conservation in a sustainable manner. A recent FAO study of urban forestry and urban greening legislation indicates that at national and sub-national levels, a clear need still exists to further develop or improve existing legal frameworks (FAO, 2005b). In the rare cases that urban forests are mentioned in national legislation, it is mostly through certain explicit provisions as part of forestry acts. Some links to urban forests are found in environmental legislation and in land use planning acts. Land use legislation and protection of urban forest resources is especially problematic in developing countries, where uncontrolled migration towards cities, poverty and lack of control lead to drastic and illegal changes in land use and overexploitation of green resources.

Most relevant legislation exists at municipal level, and deals with tree protection and restriction of tree removal. For example, the large majority of 34 European cities surveyed by Schmied and Pillmann (2003) have laws in place for protecting trees in public and private areas. If trees are protected, for example through tree preservation orders, felling is subject to official authorisation. Still, there are many exemptions to these laws, mainly due to ownership status and the location of trees. Legislation at municipal level also covers so-called hazard(ous) trees that pose a threat to public safety. Mortimer and Kane (2003) examine the topic of tree owner liability from hazardous trees in the US, pointing out that changes in legislation give private owners greater responsibility for avoiding (or preventing) tree hazards.

Research and Development and Education in Urban Forestry

Research & development

Recent years have seen the emergence of a global community of researchers working from an urban forestry perspective. Organisations such as the International Union of Forest Research Organisations (IUFRO), which has a working group on urban forestry, and the

International Society of Arboriculture (ISA) have been key players here. Researchers from developing countries are taking an increasingly active part in international research networks, aided by modern information technology and donor funding. This trend has been supported by workshops and conferences[2] on policy and development issues.

European urban forestry research has benefited from nearly a decade of networking initiatives, supported for example by the European Commission. A survey of 20 European countries identified more than 400 recent or ongoing research projects on trees and forests in the urban environment (Konijnendijk et al., 2000). A wide range of topics was being investigated by researchers, while attention to three main components of urban forests - woodlands, parks and individual trees – is about equal. Among the recent innovative research projects are those studying the impacts of urban forests on human health (Grahn & Stigsdotter 2003), economic valuation of urban forest benefits (Tyrväinen et al., 2005), and the development of participatory tools for the planning and management of urban woodlands (Van Herzele et al., 2005). Another expanding research area is that of developing and implementing information systems, such as GIS, in order to support policymaking and management of urban forests (Schipperijn et al., 2005).

Cecil Konijnedijk

Sungai Chongkak Recreation Forest near Kuala Lumpur, Malaysia

Urban forestry research and development has become most firmly established in the United States. The country's Forest Service has generated extensive new knowledge on the urban forestry concept and its benefits through its special, regional urban forestry research centres (Dwyer et al., 2000). Innovative research in the US has included the quantification of various environmental benefits of urban forests, such as air pollution reduction and climate melioration (see Dwyer et al., 2000 for examples), studies of the social and community impacts of urban forests (Kuo 2003 for an overview), and studies of the economic impacts of trees (see Wolf, 2004; also Box 14.1). Perhaps more than elsewhere, results of state-of-the-art research have been used to develop decision-support tools, such as the CITY-Green programme of American Forests (Schipperijn et al., 2005), thus strengthening the, often weak, science-policy interface.

Quantification of urban forest resources, benefits and monetary values, as well as biotic, abiotic and human threats to urban forest sustainability have been topics of the growing body of Asian literature (e.g., Jim & Lui 2001; Kwak et al., 2003; Palijon 2004; Yang et al., 2005). Australia and New Zealand have been at the forefront of studies on maintaining indigenous vegetation in urban areas and controlling invasive species (eg., Stewart et al., 2004). Recent urban forestry research in Latin America has included a study on the role of Santiago de Chile's urban forest in air pollution reduction (Escobedo et al., 2005), while experiences with municipal forest management have also been compiled for the first time (CIFOR & IDRC, 2003). Research in the region may have benefited from recent networking initiatives; urban forestry was on the agenda during a worldwide IUFRO conference held in Chile, for example (Barros, 2002).

Research needs to help assess urban forest resources, society's demands and preferences, and assist with identifying good practices in urban forestry to support planning and management. City and country case studies of urban and peri-urban forestry (FAO, 1999) showed that urban development has included important social forestry initiatives and provided important lessons for cities which are in the early stages of developing their urban forestry programmes.

Education and training

Education and training are crucial for developing the capacities needed for sound and successful urban forestry. It is important to train specialists who are able to look at urban tree resources as a whole and as a multifunctional resource, and who are aware of the contributions that different disciplines and professions can make. Education and training can take many different forms and occur at many different levels. Unfortunately, higher education (i.e. at Bachelor level or higher) on urban forestry is not yet very well developed. According to a survey, 180 educational institutions in 28 European countries offered 31 full degree programmes and 191 courses and modules that dealt with (elements of) urban forestry (Andersen et al., 2002). This seems significant, but researchers found only very few of these courses truly adhering to the urban forestry concept by taking an integrative and multi- or interdisciplinary perspective. An increase in the number of programmes and courses offered, however, was noted. Several urban forestry Master's degree programmes have recently been set up or are under development, including an international Master's programme in urban forestry and urban greening in Denmark and Sweden.

Higher urban forestry education is also uncommon and fragmented outside Europe, with the US as an exception. In the US, urban forestry has become established as a field of higher education and the number of programmes has grown over time (Miller, 2001). However, accreditation of urban forestry education, important for professional recognition, status and quality, remains an important topic of debate in the United States. The non-governmental Society of American Foresters (SAF), for example, certifies forestry schools, but no special accreditation scheme exists as of yet for urban forestry programmes. Urban forestry courses thus become accredited only through their affiliation to a general forestry school (Miller 2001). Developments in higher urban forestry-related education are evident in other parts of the world. Plans exist, for example, in Malaysia and other Asian countries to set up urban forestry curricula, possibly in twinning with programmes in Western countries (see box 14.7).

Box 14.7 *Malaysia-Denmark Twinning for urban forestry*

As part of the bilateral environmental cooperation between Denmark and Malaysia, the main Malaysian and Danish forest research and education organisations started a twinning project in 2003. The twinning aims to strengthen the cooperation between the two countries in aspects of forest research, education, policy and management as a means of promoting sustainable forest management. Urban forestry and urban greening is a main topic of the twinning. Both countries are in the process of developing higher educational programmes on urban forestry and urban greening, and are exchanging experiences, staff and students. Moreover, with the assistance of the International Society of Arboriculture, Malaysian tree care professionals are being trained and – for the first time ever - internationally certified.

Source: Forest & Landscape Denmark (2005)

In terms of training and continued professional development, some efforts have been made to establish an international standard for professional education in urban forestry. These efforts primarily concern the arboricultural (i.e. tree care) component of urban forestry and aim to establish and maintain a certain level of knowledge, professionalism and skill. Continued professional education of its worldwide membership of experts is a main objective of the International Society of Arboriculture (ISA). Professionals can be granted, for example, the status of ISA Certified Arborist, a professional vocational qualification obtained by passing a theoretical examination on tree care and management. Several countries have adopted this scheme or developed their own, with differing success (Johnston, 2001). The first group of Singaporean professionals was certified some years ago, while the first Malaysian experts were to be ISA-certified during summer 2005 with the assistance of Danish colleagues.

Urban and Peri-urban Forestry Institutions and Partnerships

The lack of recognition to urban forests at national or sub-national level, for example as a separate land use category, has limited the required long-term and cross-sectoral planning. In most countries, implementation of the urban forestry concept is restricted to the municipal level from an institutional perspective. But even at city level, green-space responsibilities are poorly defined, and many different municipal departments occupy themselves – often without real cooperation – with specific aspects of urban forestry. In Europe, for example, the planning and management of city parks, street trees and peri-urban woodland - has traditionally been the domain of different professionals and sometimes even different departments (Randrup et al., 2005).

As discussed in chapter 2, multi stakeholder approaches call for non-traditional tools and methods. Huge demands for urban forest goods and services have to be met by a small resource base, and social conflicts have been a logical consequence. Thus all urban professionals and staff dealing with tree-based green-space resources (eg. foresters, landscape architects, planners, geographers) have had to develop their "people" skills as well as conflict management capacities and learn how to involve other stakeholders in their decisions and activities. In high-pressure urban environments, partnerships are a necessity. Team work with fellow professionals, as well as close collaboration with residents and other lay people, is a must. As discussed earlier in this book for Urban Agriculture, Urban Forestry is a potentially powerful tool for community building and conflict management (FAO, 2002a) as, for example, the integration of fringe groups into the community (Ottitsch & Krott, 2005), or the improvement of transparency and forestry's image in society.

Sammy Carsan

Transportation is a major constraint to urban tree product traders- transporting Eucalyptus poles to the Market from a peri urban location in Kisumu

The development and institutionalisation of urban forestry in the United States gained force only as a result of major lobbying efforts by NGOs such as American Forests. These NGOs saw the benefits of a strategic approach to urban tree planting and management for generating multiple benefits. Awareness raised by these NGOs led to strong links between research, policy and implementation of the urban forestry concept, resulting in national, state and local urban forestry institutions being developed. Great Britain's National Urban Forestry Unit (NUFU), an independent organisation, has provided assistance to a large number of local and regional urban forestry initiatives (Konijnendijk, 2003). The role of high-level politicians in raising awareness is important. Large-scale tree planting campaigns can be a tool to gain political commitment as well as public awareness. Eighty thousand residents of Puerto Princesa City in the Philippines, for example, were made aware of the benefits of urban forestry through their involvement in a massive local reforestation project (Palijon, 2004).

New institutions that have sufficient flexibility for managing forests and other natural resources are also needed. The independent project teams that coordinate the English community forests set up near large agglomerations, for instance, operate in close collaboration with a range of public and private actors. These teams combine skills such as forestry, ecology, planning, marketing, and community relations and involvement (eg. Jones et al., 2005). The call for municipal coordination and a higher level of service in green-space management was also responded to in Johannesburg, South Africa, where a City Park Office was created along the principles of new public management (box 14.8).

Box 14.8 *What is the Johannesburg City Parks Agency and how does it work?*

As the City of Johannesburg tries to run on more efficient, business-like lines, various services have been reorganised into self-contained "utilities" and "agencies". Utilities have been formed for services that can be charged directly to individual consumers, such as electricity and water, while agencies have been created to look after the city's roads and parks. These agencies charge the city council for services rendered. Johannesburg City Parks is one such agency that is run by a managing director and a board of directors who report to the city manager.

Previously, parks services were fragmented across Greater Johannesburg's five councils. This led to confusion about who was responsible for what and resulted in different standards being applied across the Johannesburg region. There was a definite under-supply of developed parks in township areas. Now, with the agency being run on strictly business lines, the goal is to build and maintain more parks within the existing budget. This will certainly be a benefit to tax payers.

Source: FAO (2005b); http://www.johannesburg.gov.za

For developing urban forestry institutions and capacities, networking between researchers, policymakers, practitioners as well as other stakeholders is crucial. COST Action E12 Urban Forests and Trees, a scientific and technical network financed by the European Commission, helped put urban forestry on the map in Europe. The role of FAO, IUFRO and ASEM in building North-South cooperation was already mentioned. Information brokers such as the Resource Centre for Urban Agriculture and Forestry (RUAF, www.ruaf.org), US-based TreeLink (www.treelink.org), and the European Urban Forestry Research and Information Centre (EUFORIC, www.sl.kvl.dk/euforic) assist with the development of research, policy, education and implementation of partnerships. City twinning and networking, implemented in many different contexts, is another tool for networking and capacity building. United Cities and Local Governments (UCLG, www.cities-localgovernments.org/uclg), for example, acts as "united voice and world advocate" of democracy-based self government and works together with the United Nations in meeting the Millennium Development Goals[3] at local level. Within FAO, the Priority Area for Interdisciplinary Action (PAIA) "Food For The Cities" provides a means to improve intersectoral actions in urban and peri-urban areas for poverty alleviation (eg., considering aspects of nutrition, health, agriculture, forestry, and fisheries). Bringing in its focus on trees as a major, multifunctional component of green structures and its base of expertise and knowledge developed over 40 years or more, urban forestry can be joined with other concepts and fields in the quest for sustainable urban development.

Needs and perspectives

Policy needs and perspectives

Urban forestry requires a strategic perspective and the development of targeted, specific policies and of sufficient capacities in order to be successful. Much remains to be done, as the planning and management of "green" is often still a rather single-sector activity, carried out by foresters and other natural resource professionals but with limited involvement of, for example, social scientists and local communities. On the other hand, the planning related to "land" (including real estate aspects) is being carried out by other professionals and services, such as urban planners and landscape architects. Further development of urban forestry and enhancing its contribution to sustainable development at large require a bold and strategic approach. Task-oriented, comprehensive urban forestry is a term coined by Ottitsch and Krott (2005), and presupposes that urban forestry will only be successful if it establishes direct links to urban demands and tasks at hand, like infrastructural works, the integration of marginal groups, and improving city competitiveness and image, for example.

Although the positive aspects are dominant, the potential negative aspects of forests and trees close to residential areas such as wildfires, diseases, and increased allergies should be kept in mind. A bad Selection of tree species, the roots of which eventually cause damage to infrastructure, can lead to the rejection of tree planting altogether. Some argue that urban parks are often places of crime and illegal activity. In certain cases, planting of trees has been used for claiming rights of ownership to land, thus becoming a major cause of conflict.

Yemi Akinbamijo

High-density cultivation of Moringa in Banjul

The benefits of urban forests should be directed towards local communities, and legal, economic and institutional arrangements should be in place to ensure this. Currently, land tenure practices in many – especially developing – countries has obstructed real community "ownership" of urban forestry and related activities. Moreover, planning and management of urban forest resources is becoming increasingly complex (eg., Dwyer et al., 2001), their outcomes are becoming more significant to people, and the number of individuals and groups involved in planning and management processes is growing. This calls for a close collaboration with research, so that decisions can be based on a sound, comprehensive knowledge base.

Research needs and perspectives

Several recent assessments have captured the gaps in knowledge and the research needs within urban forestry. Liu et al., (2004), for example, mention that more information about the size and structure of urban forest resources is needed in China. Other priority topics for research mentioned are species selection, managing pests, diseases and abiotic stress caused for instance by air pollution, and the development of information systems to support planning and management. Nilsson et al., 2005 also list more studies on the characteristics of urban sites and improving tree adaptability to sites as research priorities for Europe. Urban sites are associated with a range of biotic, abiotic and human pressures, for example related to pests and diseases of vegetation, traffic emissions, de-icing salts, and vandalism. Other research needs relate to the development of environmentally-sound management methods, studies of public preferences and changing demands for urban forest benefits, assessment of these benefits and their incorporation in strategies for sustainable development, and the development of better information and public participation tools. Several of the research needs identified for the USA are similar (Dwyer et al., 2001). They include more research to: improve the comprehensive health of urban vegetation; improve resource inventory and monitoring; promote dialogue between urban forest owners, users and managers; foster collaboration among agencies and groups; improve understanding of how forest configuration influences forest use and benefits; create better understanding of urban forest health; and enhance dissemination about urban forest benefits and management. Overall research needs, mentioned in various reports as well as discussed in this chapter, are supposed to enhance collaboration between disciplines and fields of attention, as well as between scientists, planners and managers.

The need for technology transfer and information sharing exists not only within countries, but also between countries and the world's regions. Calls for research networking, identification of centres of research excellence, and the establishment of demonstration urban forests have been mentioned earlier in this paper. In order to meet these calls and make sure that developing countries are not excluded, sustainable donor and other funding options need to be explored.

Educational needs and perspectives

Education that incorporates an urban forestry perspective is still in its early stages of development, especially in the developing world, but important steps have been taken recently. Programmes and courses should make an effort to focus on the strengths of the urban forestry concept, incorporating multiple perspectives and disciplines, and taking a comprehensive view of the urban forest resource. Initiatives taken in the direction of international cooperation in education should be encouraged. Tertiary education is one area of focus, while training and continued professional development is another. The work of ISA and other organisations to enhance the professionalism of green-space practitioners, for example by international certification and accreditation, should be supported and further developed.

Guy Kramer

Enjoying walking under the trees

Urban forestry for development

The experiences described above show the significant potential of urban forestry, also for developing countries. However, in promoting urban forestry, its basic strengths should be kept in mind. The concept promotes inclusiveness in terms of involving experts, policy-makers and stakeholders from all walks of life. The need to join forces with other initiatives aimed at sustainable urban development is therefore crucial. Urban forestry needs to be considered within the context of other comprehensive concepts for natural resource management and land use in urban areas, at the urban fringe, and at the urban-rural interface, such as urban greening, green structure planning and landscape planning, several of which have been discussed in this book (in chapters 3 and 4). In terms of providing urban livelihoods and helping cities to "farm for the future", it is obvious that urban forestry should be closely linked with urban agriculture. Trees can provide significant benefits when used in urban agroforestry systems, such as by improving site conditions for growing crops, providing fodder, and offering wood and non-wood forest products that can help diversify production.

Notes

[1] Urban forestry and urban agriculture are not the only relevant new concepts that have emerged. "Urban greening", for example, has been defined as the planning and management of all vegetation to create or add value to the local community in an urban area (Kuchelmeister 1998). Although the main difference between urban greening and urban forestry may seem the former's explicit inclusion of all non-tree dominated vegetation in urban areas, differences between the two concepts are more fundamental. From this point of view, urban "greening" would also comprise urban "agriculture". Urban forestry has developed into a science-based field of activity, and, in

different countries, a recognised field of expertise in which professionals from various disciplines (eg. landscape architects, foresters, geographers) can specialise. This is not (yet) so in the case of urban greening, which is a concept, mainly based on activity or philosophy (Randrup et al 2005). It is being developed primarily in a developing country context, as was the case with community forestry before.

[2] These include, amongst others, events organised by FAO and the Forest Environmental Cooperation of the Asia-Europe Meeting (ASEM). The latter hosted a well-attended Asian-European workshop on urban forestry in Suzhou and Beijing, China, at the end of 2004. Participants at both events called for enhanced international cooperation and networking, for example at the regional level, as well as establishment of national and regional centres of excellence for urban forestry, and demonstration urban forests (ASEM 2004). FAO events have included the World Forestry Congresses, the Expert consultation on trees outside forests in November 2001 (FAO 2002b), and a workshop on urban forestry in Tehran, Iran, July 2003.

[3] The United Nations set out the following Millennium Development Goals to be achieved by the year 2015: 1) Eradicate extreme poverty and hunger; 2) achieve universal primary education; 3) promote gender equality and empower women; 4) reduce child mortality; 5) improve maternal health; 6) combat HIV/AIDS, malaria and other diseases; 7) ensure environmental sustainability; and 8) develop a global partnership for development (source: http://www.un.org/millenniumgoals/)

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Urban Forestry in China: Status and Prospects

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Over the last 20 years, a rapid process of urbanisation has taken place in China due to increasing economic development. Between 1983 and 2003, the number of cities and towns in China increased 2.5 times to about 50,000, and the urban population made up about 40 percent of the country's total population.

Chunjiang Liu

The Yanzhong green-space with an area of 210,000 m^2, located at the city centre, is the largest public green-space in Shanghai.

With the increase in the number of urban areas and in the total urban population, environmental problems have aggravated, as in too few outdoor leisure areas for city dwellers, mass destruction of natural landscapes, loss of biodiversity, water source pollution, and increased CO_2 emissions. Scientists and policymakers have accepted urban forestry management as one important strategy to improve urban living and working environments (Jiang, 2003). In the middle of the 1980s, Shen et al. introduced the term "urban forestry" to China (see Li et al., 2004), and Gao (1984) published the book *Urban Forest* in Chinese. More recently, research projects have been initiated to better plan the development of urban forests in certain cities (Chinese Academy of Forestry Sciences & Huadong Normal University, 2002), education programmes on urban forestry have been launched in several colleges, and a special research journal, *Journal of Chinese Urban Forestry*, has been established (in Chinese in 2003).

History

In historical China, city dwellers primarily used the natural forests and trees within and around a city for hunting, gathering fruits and plants, collecting fuelwood, etc. Also, in ancient Chinese cities, it was very popular to plant trees along the rivers and streets and maintain a small patch of trees around the houses. These trees and small areas of forest were managed for multiple purposes, eg., for shade, to serve as windbreaks, as beautiful scenery, to provide food in the form of fruits and leaves. Traditionally, people also planted trees or a stand around their houses to create or maintain a good *Feng-Shui* for the houses. In addition, there is a long tradition of establishing gardens and parks for the imperial family and higher-ranking officials. For instance, in the Summer Palace in Beijing, the most famous imperial park remaining in China, the Wanshou Hill is almost fully covered with two of the most common evergreen conifers in northern China, Chinese pine (*Pinus tabulaeformis*) and *Platycladus rientalis*. Even today, these forests are still important parts of the city's urban forest.

At the beginning of the 20th century, some Chinese scholars who had studied abroad brought the ideas of modern forestry as practised in Western countries to China. With a better understanding of forest functions in terms of environmental protection and recreation, these Chinese scholars attempted to establish forests in the areas around Beijing and Nanjing with the purpose of conserving water and soils, as well as to provide opportunities for recreation. Starting in 1949, the new Chinese government launched a movement of massive afforestation close to cities as well as in remote areas. In Beijing, the new capital of China, for instance, many plantations were established around the city aimed at water and soil conservation and at offering recreational opportunities for city dwellers (see article by Jianming et al., on page 26).

In the 1980s, with a rapidly growing economy, urbanisation intensified in China, causing new environmental challenges. In this context, modern urban forestry was introduced to China as the country opened up to the outside world, and terms such as "urban forest" and "urban forestry" became popular in scientific literature and the news media (Li et al., 2004). In order to improve urban environmental conditions, long-term planning of urban forestry was made part of a national development strategy during the 1990s (Gao, 2003). According to the planning of China's urban forest development, the overall goal is to expand the cover of urban forests and trees to 45 percent in 70 percent of cities by the year 2050. Today there are several cities, eg. Changchun, Nanjing and Guangzhou, with a forest cover of more than 40 percent.


Chunjiang Liu

Temples near a city are commonly important parts of its urban forest: Daming Temple, Yangzhou, Jiangsu Province.

Since the 1980s, developing urban forests has become an important part of municipal planning as a whole, and urban forests have been established according to a design that caters to the need for recreational opportunities and environmental protection. In 1989, Changchun, the capital of Jilin province, began to carry out a programme of developing a "forest city", thus being the first city to have this as a goal of city development (Jiang, 2003). In 2001, the planning of urban forest development was worked out for Shanghai, the biggest city in the country, with the goal of reaching 35 percent forest coverage by 2020. This figure was calculated based on O_2 emission, CO_2 sequestration, water sources protection, recreation, etc. (Chinese Academy of Forestry Sciences & Huadong Normal University, 2002). In 2002, a plan for urban forest development was made for the capital city of Huaining county (Jiang, 2003). This shows that not only big cities but also medium and small cities have become involved in the planning and development of their urban forests.

A second change that has occurred since the 1980s is that urban forests are now being managed for multiple purposes, so that they can fulfill their potential roles in recreation, water sources protection, biodiversity conservation, atmospheric CO_2 sequestration, air pollution reduction, among others. Of course, different cities located in different parts of the country may emphasise different functions of urban forests. Due to the heavy air pollution in most Chinese cities, however, all of the trees and forests in a city are expected to have a high capability of retaining dust and absorbing SO_2, NO_2, and other pollutants (Guan & Liu, 1999; Wu et al., 2004).

A third change is that private companies have become involved in developing urban forests, just as they are engaged in other commercial activities in China. In the past, governments had to call for and organise people to establish forests, but now this work can be done as a commercial activity, and this has added a new driving force for urban forest development in China.

The fourth feature of China's new urban forestry policies is that managing urban forests is done as a way of reducing poverty in local areas. In Beijing, for instance, forests in suburban areas have been attracting more and more tourists, especially during weekends and holidays (Qu, 2003). These visitors not only create many jobs at local hotels, restaurants, and other such outlets but also provide an opportunity for farmers to sell their agricultural produce, such as fruits, vegetables, and wood and stone handicrafts. At the same time, this opens a window for the exchange of information between people living in urban areas and those living in rural areas. This stimulates the enthusiasm of local people to get involved in urban forestry.

Developing Urban Forestry

In China, generally, one important limiting factor for developing urban forests in a city is insufficient investments due to shortage of funds, mainly because these forests do not produce direct economic benefits, and therefore do not attract private companies so much as other industries do in a city. It is necessary for the government to invest in urban forestry, as one aspect of a city's infrastructure, but diversification of fund raising should also be advocated. Due to the exceptional position of Beijing as the capital city, several international cooperation programmes support its urban forest development. From a research perspective, some long-term observation stands should be established so that a set of complete data on urban forests can be compiled. In addition, based on different conditions in terms of climate, species composition, and urban environment, it is good to establish demonstration forests. Results from studies and experiments in these areas can then guide future urban forestry practice. There is also a need to increase the involvement of the public, local inhabitants and tourists in particular, in the development of urban forests in China, a country with a rather short history of modern urban forest management. In this aspect, the most important task is to raise awareness about the role of forests in improving the environment by means of newspapers, magazines, TV, and other media.

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Agroforestry in Peri-urban Cities of Abia State, Nigeria

Stella N. Odurukwe

Abia is one of the 36 states of Nigeria and is located in the southeastern geopolitical zone of the country. The state encompasses two main urban cities, namely Aba and Umuahia, and many other periurban cities such as Bende, Ohafia, Isikwuato, Uzuakoli, Mbawsi and Obehie. These areas have attained the status of periurban either as a result of their nearness to the larger cities Aba and Umuahia or as a result of being local government headquarters.

The agroforestry practices of 180 households (60 households per city) of three of these periurban cities: Uzuakoli, Obehie and Isikwuato, were examined in 2003. The different agroforestry practices reported by the households corresponded to the various needs of the households and their land tenancy arrangements (see Table 14.2). Multi-storey home gardening was reported by 31 percent of the respondents, all of who are landowners. Their involvement in this practice was attributed to the need to ensure family food security, provide different fruits all season long, maintain soil fertility and generate additional income. Multi-storey home gardening is a practice that involves the growing of annuals and perennials in association with crop rotations ranging from a few months to many years (Evans 1992). Such systems are usually characterised by the use of trees, shrubs, creepers and climbers. As much as 17 percent of the respondents reported that they earned a high income of between N 92,000 and N 61, 000 from the sale of various products of multi-storey home gardens such as fruits, food crops, vegetables, leaves, seeds, bark, fuelwood, etc. Medium incomes of between N60, 000 and N 30, 000 were generated by 52 percent of the respondents, while about 31 percent reported incomes below N 30, 000 from the sale of such products.

Stella Odurukwe

Benefits of urban agroforestry can be realised if policies ensure adequate planning

Table 14.2 *Agroforestry practices in the periurban cities*

Agroforestry practice	Percentage of the population
Multistorey home garden	31
Woodlots	11
Amenity planting	39
Live fences	53
Alley cropping	0
Improved fallow	5
Taungya system	18
Dispersed multipurpose trees on cropland	68
Border planting of trees	76
Trees and shrubs on eroding sites	58
Wildlife agroforestry	9

Border planting is common on both government and private lands. The respondents reported using border planting to enhance the aesthetic value of their surroundings, demarcate boundaries, control water and wind erosion, cultivate live fencing, and supplement their supply of food, fodder and fuelwood. The choice of plants used for this purpose included timber species such as Gmelina arborea, neem, and Eucalyptus sp., perennial fruit trees such as Elaeis guinensis (oil palm), Cocos nucifera (coconut), mango, Citrus sp., and shrubs such as Vernonia amydalina (bitter leaf), Pitangia cherry, etc. Wildlife agroforestry for cane-rat production was reported by 6 percent of the households and bee pasturage was reported by 3 percent.

Division of labour

Women and children dominate in the maintenance of home gardens for vegetable production. They clear the land adjoining residential quarters and private houses, prepare the ridges, plant and tend the vegetables. On average, 72 percentof the households involved in this activity use the services of almost all the members of the family. Both men and women are involved in the cultivation of multipurpose trees and shrubs (MPTS) around home gardens, such as citrus, oil palm, coconut, mango, avocado pear, pawpaw, Africa pear and guava. In 89 percent of the interviewed households, annual crops such as maize, cassava, yam, okra and garden egg are planted in combination with vegetables and multipurpose trees. This activity involved more women than men. Men feature prominently in yam cultivation since yam is commonly regarded as a men's crop in the study area. Women and children are solely responsible for weeding agroforestry farms, maintaining soil fertility and watering the plants (especially vegetables) during the dry season.

Access to and control over land

About 58 percent of the interviewed households are owners of the land on which they practise agroforestry. These landowners exercise full control over the land, what is planted, and how the proceeds are used. 36 percent of the respondents carry out agroforestry on land attached to government residential quarters and offices, which they occupy. They have control over the planted crops but not over the land, and thus run the risk of losing their crops if they move out and a new occupant occupies their office or residential quarter due to staff transfer, retirement, retrenchment or termination.

Only 16 percent of households practise agroforestry on government-owned wastelands and open spaces, and on lands belonging to others. Land belonging to another individual is usually held on trust and a special agreement is reached between the landowner and the tenant. Such tenants cultivate a variety of crop combinations from perennial multipurpose trees to annual crops and vegetables. These tenants have the least control over the land they use for agroforestry; they run the risk of losing all their crops at the slightest provocation of the individual landowner or the government parastatal that owns the land. Continuous cultivation of such lands despite the high level of insecurity is attributed to constraints in access to land (the majority of those who are involved are aliens), in addition to a strong desire to ensure family food security and earn additional income. Thirteen of the respondents belonging to this category reported situations in the past when the original landowners bulldozed the crops planted on the land (even before they reached maturity) because they wanted to start up a development project on the land.

Stella Odurukwe

Border planting is common on both government and individually owned lands

Benefits
An assessment of the benefits and potentials of agroforestry revealed positive impacts on the lives of the respondents. They attributed both economic and environmental protection benefits to agroforestry. The respondents unanimously mentioned family food security as the most important benefit of agroforestry as it ensures the availability of different food varieties all year round. 75 percent of the households reported having increased their income from the sale of agroforestry products and by-products including fruits, wood, leaves, seeds, fibre, etc. In addition, 91 percent claimed that agroforestry has improved their environment by improving soil fertility, reducing wind and water erosion, purifying the surrounding air, and beautifying the environment. A mere 3 percent reported that it provides food for their livestock. This low response corresponds to the small number of periurban dwellers who keep livestock.

Problems
The need to reap the benefits of urban agroforestry has resulted in many incidences of reckless planting of multipurpose trees on areas reserved for other purposes, thereby causing obstructions as reported by 68 percent of the respondents, and encroachments on public lands as opined by 54 percent. About 36 percent of the respondents reported cases in which trees planted on dual carriageways caused road accidents when such trees were felled by thunder or heavy trucks. Cases of electrocution arising from trees planted close to high-tension electric wires were also reported by 25 percent of the respondents. 7 percent of the households reported incidences of armed robbers climbing into the compound y way of the fruit trees planted close to the fence. About 27 percent of the respondents believe that practising agroforestry close to residential buildings constitutes a health hazard since it encourages the breeding of insects (mosquitoes, cockroaches, etc.), rodents and snakes.

Recommendations

City farmers should form cooperatives and make formal requests for state land to be used for agricultural production.

The potentials of periurban agroforestry can be fully realised only if policies that ensure adequate planning, management and monitoring of these practices by the relevant government agencies are put in place. The state and local governments should develop policies aimed at proper allocation of public vacant lands to registered city farmers. The state environmental protection agency should intensify efforts towards proper planning, monitoring and management of amenity planting and farming activities around the cities. Agroforestry practitioners are advised to carry on these activities some distance away from the buildings in which people live.

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Bringing Town and Country Closer Together: Community Forests in North East England

Clive Davies
Jonathan Scurlock

The Community Forest programme in England, announced in 1988, started as an experimental initiative by the Countryside Agency and the Forestry Commission, with an ambitious vision for the creation of well-wooded landscapes in and around major urban areas to be used for work, wildlife, recreation and education.

One of the largest physical regeneration programmes ever launched in the UK, the initiative comprises 12 designated "Community Forests" that cover some 450,000 hectares, or nearly 2 percent of UK land area. The Community Forests programme has evolved and grown into an important exponent of landscape-scale change, and is helping to bring strategic environmental thinking to a wide range of environmental, social and economic agendas.

Watergate Forest Park, Gateshead. A new community woodland on reclaimed colliery land in the Great North Forest, North East England.

The term "community forestry" is applied in a number of different contexts around the world, although its definition and characteristics remain quite similar. According to the UN Food and Agriculture Organisation, community forestry entails the "control, management and use of forest and tree resources by local communities; respect for social, economic and cultural relationships between people and forests; and a decentralised and participatory approach to forest management" (www.fao.org/forestry/site/14111/en)

In England, the Community Forests cover large areas around the edges of towns and cities - but unlike the great forests, which used to cover extensive parts of northern Europe, they are not continuous plantings of trees. Instead, these Community Forests comprise a rich mosaic of wooded landscapes and land uses including farmland, villages, leisure enterprises, nature areas and public open spaces. They are intended to create areas rich in wildlife, whilst making provisions for access, leisure and education - providing attractive areas in which to live, conduct business and enjoy leisure time.

Woodlands provide a good environment for recreation and can absorb relatively large numbers of visitors without loss of visual amenity or damage to habitats. Promoting recreation in the Community Forests includes maximising access to new and existing areas of woodland, creating new and interesting routes for walking, cycling and riding, and providing opportunities for leisure activities ranging from small picnic areas to woodland parks. Further opportunities for developing amenity exist through the creation and maintenance of small woodlands in more densely populated urban areas. Greenways (car-free roadways, often tree-lined) may be established to link points of interest, by connecting them to existing networks of cycle paths and footpaths.

North East Community Forests

Extending roughly 80 km to the north, south and west of the city of Newcastle, the North East of England is the smallest English region, with about 4 percent of the UK's population, land area and economic output. Formerly dominated by energy production, heavy industry and manufacturing, the region has seen enormous change over the past 30 years, and is still dealing with the economic, social and structural consequences of its past - including a legacy of derelict and unused urban and periurban land. Average incomes are lower than in most of the rest of the UK, and some of the most socially deprived living conditions are found in the North East - although there are wide variations in standards of living across the region. The extensive rural areas of the region were traditionally dependent on farming, forestry and mineral extraction, but tourism has grown in importance, building on the region's strong cultural identity and outstanding natural landscapes.

The North East has two designated Community Forests – The Tees Forest (set in the valley of the River Tees) and the Great North Forest (covering the lower Tyne and Wear river valleys and north County Durham). Established in 1991 and 1990, respectively, they are highly regarded as successful partnership organisations, involving a total of 11 out of the region's 25 local government authorities, as well as the national Countryside Agency and Forestry Commission. The Great North Forest (http://www.greatnorthforest.co.uk/) covers an area of 249 square kilometres, while The Tees Forest (http://www.teesforest.org.uk/) encompasses some 350 square kilometres. These recognised "brand" names have now been brought together under one heading as North East Community Forests.

Jonathan Scurlock

Community forests in the periurban landscape: view from Falkland Ridge, near New Marske in the Tees Forest, North East England.

Over the last 13 years, the two Community Forest organisations in North East England have undertaken a wide range of activities in urban and periurban areas, helping to create a more attractive and well-wooded environment with accessible and sustainable managed landscapes that enhance the health, well being and quality of life of the local people. High-quality, well-wooded functional environments have been created in the rural-urban fringe, delivering a better quality of life for the people of the region. The environmental projects translate regional and national policy strategies into practical action.

Community Engagement and Learning

Community Forests have contributed to the evolution of forestry policy in England, from its traditional focus on timber and rural employment to a multifunctional agenda based on the contribution of woodlands to economic regeneration, rural development, recreation and access, environment and conservation. The Community Forests also offer proven and effective partnership mechanisms through which to integrate urban and rural policy and deliver sustainable development. The UK government's Urban White Paper and Sustainable Communities Plan set out an ambitious agenda for delivering an urban renaissance, as well as addressing the problems of neighbourhood decline and the need for new housing in different parts of England. Demonstrating and strengthening the relationship between town and country, through mechanisms such as community forestry, can enable this rural and urban renewal.

Implementation of community forestry requires public involvement. North East Community Forests are increasing the involvement and inclusion of communities and individuals, and empowering communities to become strong advocates for community forestry and local environmental action. The long-term objective is to create a substantial caucus of support within the community, which will in turn influence politicians and decision makers to take positive steps that aid Community Forest implementation.

By promoting and delivering programmes that foster local environmental action, the Community Forests partnership is seeking to create "'community forests for all". This has the added benefit of raising awareness of its activities in areas of society that are not normally affected by the issue of 'forestry', such as planning policy, health services, regeneration, transportation and economic development. Tools to involve the community include theatre productions, festivals and events, public transport initiatives, labour market training schemes and conservation volunteering and training.

The periurban environment provides opportunities for hands-on learning in a variety of outdoor settings. The educational sector of the programme supports all parts of the UK national school curriculum, with an emphasis on environmental education and rural studies. Further learning opportunities include vocational training for older students as well as "lifelong learning" for adults, especially in the practical skills needed to maintain the environmental and recreational fabric of these periurban areas. A key dimension in the approach is therefore to employ community engagement and education specialists within the Community Forest teams.

Financing and Value Added

Jonathan Scurlock

Promotion of energy crops. Jonathan Scurlock, NECF Renewable Energy Project Manager, and Robin Twizell, of local farmer-producer group REFA hold bundles of coppice willow for planting in the field behind them.

Financial support for the Community Forests in England comes from a range of sources. The Department for Environment, Food and Rural Affairs, the Forestry Commission and the Countryside Agency fund forest planting, management, restoration of derelict land and provision of leisure facilities. Additional support comes from partnerships with local governments and industry, as well as the voluntary sector. A major reason why Community Forest partnerships were established was to "add value" to the individual work of local stakeholders including local government authorities. Evaluations of the North East Community Forests programme in the past year have shown high value-added outcomes.

The Community Forest organisations in North East England have now established themselves is as "North East Community Forests Limited" **(1)**. This a new not-for-profit company, owned and operated by public sector partners, with a tightly defined role as: a strategic partner for the region's existing Community Forests and their local authority partners; a new delivery partner for the Forestry Commission and Regional Forest Strategy; and an innovative project partner for the regional development agency ONE NorthEast, the Countryside Agency, its successors, and other regional agencies.

North East Community Forests Limited (NECF) aims to achieve its wider goals by accessing investment funds, piloting new initiatives and facilitating land ownership for projects that deliver wide-ranging environmental, social and economic benefits. Some of these new products and services may also be applicable in other national contexts, including both developed and developing countries, to help bring rural and urban areas closer together wherever community forestry is practised.

Note

Also see the website of the North East Community Forests: http://www.necf.org.uk

Resources

Municipal Forest Management in Latin America
CIFOR, IDRC (2003) Municipal forest management in Latin America. Ed. by Ferroukhi L. CIFOR, Bogor. 236 p. This book is probably the first serious attempt to analyse recent experiences of municipal participation in forest management in Latin America. It is the product of a series of investigations in Bolivia, Brazil, Costa Rica, Guatemala, Honduras and Nicaragua carried out by more than 30 national and international researchers. It offers required reading for anyone concerned with municipal administration and natural resource management.

Trees Outside Forests – Towards Better Awareness
FAO,CIRAD (2002) Trees outside forests – Towards better awareness. FAO Conservation Guide # 35. FAO, Rome, 2002. 218 p. Trees outside forests, together with forests and other woodland, play an essential role in solving important problems of rural and urban populations. People, however, do not fully benefit from these important roles, because trees outside forests are neither well perceived nor well documented, and receive little attention in the formulation of national forestry policy and planning. This document is a product of important synthesis work and collaboration, and an attempt to fill in the gaps.

Urban forests and Trees – A reference book
Konijnendijk CC, Nilsson K, Randrup TB, Schipperijn J (eds) Urban forests and trees. Springer, Berlin, 520 p. This first European reference book on UPF (Urban and Peri-urban Forestry) covers all aspects of planning, designing, establishing and managing forests and trees in and near urban areas. The disciplinary background of the authors is varied, ranging from forestry and horticulture to landscape ecology, landscape architecture and even plant pathology.

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"Local People, Devolution and Adaptive Collaborative Management" is a programme run by the Centre for International Forestry Research, which applies adaptive management in the forests of Indonesia, the Philippines, Nepal, Cameroon, Ghana, Malawi, Zimbabwe, Bolivia and Brazil. There are many excellent resources available on the site, including reports, journal articles, books and CD-ROMs. The collaborative

software packages Co-learn and Co-view, which are designed to help stakeholder visioning and provide other computer-based learning support tools for adaptive management programmes, particularly in developing countries, is also available here.

www.fao.org/forestry/index.jsp
This takes you to the urban forestry pages of FAO web site with a number for FAO publications that can be accessed electronically. The annotated bibliography was compiled from material obtained from the FAO Forestry Department, the TREE Data Base of CABI and AGRIS. When first published in 1995, the bibliography contained 557 references, but the web version is currently being updated:

www.isa-arbor.com/home.asp
The International Society of Arboriculture is a worldwide professional organisation dedicated to fostering a greater appreciation for trees and to promoting research, technology, and the professional practice of arboriculture. The *Journal of Arboriculture* is a bi-monthly refereed journal published by the Society devoted to the dissemination of knowledge in the science and art of planting and caring for trees in the urban environment. ***http://joa.isa-arbor.com***

www.sl.kvl.dk/euforic
Although EUFORIC, the European Urban Forestry Research and Information centre, has moved its web site, some key internet links to urban forestry van be found at: www.sl.kvl.dk/links.htm.

www.agroforester.com/overstory/osprev.html
The Overstory is a free non-commercial e-mail journal for agroforestry practitioners, researchers, professionals, and enthusiasts. Each issue focuses on a concept of tropical agricultural systems, which integrate trees and other perennial plants. You can subscribe to the journal by sending an e-mail to overstory@agroforester.com.

www.forestry.lib.umn.edu/bib/urban.phtml
This site provides bibliographic references on urban forestry.

www.elsevier.de/ufug
This site provides access to an important electronic periodical on urban forestry: Journal on Urban Forestry & Urban Greening.

www.treelink.org
TreeLink is an Urban and Community Forestry information portal and networking centre.
This site has been created with the purpose of informing, educating and inspiring people working in urban and community forestry.

www.iufro.org/science/divisions/division-6/
The International Union of Forest Research Organisations (IUFRO) has a working group on urban forestry. IUFRO is the main global network for forest science cooperation. It unites more than 15,000 scientists in almost 700 member organisations in over 110 countries.

List of Acronyms and Abbreviations

AGROPOLIS	International Graduate Research Awards Program in Urban Agriculture (IDRC)
AGUILA	Agricultura Urbana Investigaciones – Latinoamerica (Latin American Regional Network for Urban Agriculture)
ALDEP	Arable Lands Development Programme (Botswana)
ASDA	Abidjan Urban Master Plan
BOD	Biochemical Oxygen Demand
CBUA	Community Based Urban Agriculture
CEAH	Centre for Human Environment Studies (Argentina)
CEDA	Citizen Entrepreneurial Development Agency (Botswana)
CEPAR	Centre for Agro-Ecological Production Studies (Argentina)
CEPIS	Centro Panamericano de Ingenieria Sanitaria y Ciencias Ambientales (Pan American Centre for Sanitary Engineering and Environmental Sciences, Peru)
CFF	Cites Farming for the Future Programme (RUAF)
CFP	Cities Feeding People Program Initiative (IDRC)
CGIAR	Consultative Group on International Agriculture Research
CIDA	Canadian International Development Agency
CIP	Centro Internacional de la Papa (International Potato Center, Peru)
CIRAD	Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement (Centre for international cooperation in agronomic research for development, France)
COD	Chemical Oxygen Demand
CSA	Community Supported Agriculture
CTA	Technical Centre for Agricultural and Rural Cooperation (The Netherlands)
DFID	Department for International Development (United Kingdom)
ECODESS	Ecology and Development with Sustainable Sanitation
EMATER	Empresa de Assistencia Tecnica e Extensao Rural do Estado (State Rural Technical Assistance and Extension Service, Brazil)
ENDA	Environnement et Développement du Tiers Monde (Environment and Development for the Third World, Senegal, Zimbabwe)
ETC	ETC Foundation
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAP	Financial Assistance Programme (Botswana)
FFS	Farmer Field Schools
FTG	Friends of Troy Gardens
FS	Farming System(s)
FSA	Farming Systems Analysis
GIS	Geographic Information System
GMO	Genetically modified organism
GNI	Gross National Income
HYOG	High Yielding Organoponiic Gardens
IAGU	Institut Africain de Gestion Urbaine (African Urban Management Institute, Senegal)
IBGE	Instituto Brasileiro de Geografia e Estadística (Brazilian Institute for Geographical and Statistical Information)
ICRAF	World Agroforestry Centre (formerly International Council for Research in AgroForestry)

IDRC	International Development Research Centre (Canada)
IFAN	Institut Fondamental d'Afrique Noire (Basic Institute of Black Africa, Senegal)
IFPRI	International Food Policy Research Institute
IITA	International Institute
ILRI	International Livestock Research Institute
INWRDAM	Inter-Islamic Network on Water Resources and Development and Management (Jordan)
IPES	Instituto Peruano de Promoción del Desarrollo Sostenible (Peruvian Institute for the Promotion of Sustainable Development)
IPM	Integrated Pest Management
IRDAS	Institute of Resource Development and Social Management
ITDG	Practical Action (formerly the Intermediate Technology Development Group)
IWMI	International Water Management Institute
KMA	Kumasi Metropolitan Assembly
LAC	Latin America and the Caribbean region
MACLT	Madison Area Community Land Trust
MDG	Millennium Development Goal
MDP	Municipal Development Partnership for Eastern and Southern Africa (Zimbabwe)
MENA	Middle Eastern and North African
MOVE	Market Oriented Value Enhancement (India)
MPAP	Multi-stakeholder Policy making and Action Planning
MPN	Maximum permissible number
MPSACCO	Mahila Prayas Savings and Credit Co-operative Ltd (Nepal)
MSPs	Multi-Stakeholder Processes
NGO	Non-governmental organization
NRI	Natural Resources Institute (United Kingdom)
PAIA	Priority Area for Interdisciplinary Action (FAO)
PB	Participatory Budget
POG	Popular Organoponic Gardens
PRA	Participatory Rapid Appraisal
PROVE	Programmea de Verticalisação da Pequena Produção Familiar
PTD	Participatory Technology Development
REDE	Resources for Development Association (Peru)
RUAF	International Network of Resource Centres on Urban Agriculture and Food Security
SARS	Severe Acute Respiratory Syndrome
SCAGA	Siyazama Community Allotment Garden Association
SGUA	Support Group on Urban Agriculture
SIUPA	Strategic Initiative on Urban and Peri-urban Agriculture (now Urban Harvest)
SL	Sustainable Livelihoods
SMIC	Secretaria Municipal da Produção, Indústria e Comércio (Municipal Secretary for Industry, Production and Commerce)
SPFS	Special Action Programme on Food Security (FAO)
SSA	Sub Saharan Africa
SSACCO	Samudayik Savings and Credit Co-operative Ltd (Nepal)
SUSPER	Sustainable Development of Peri-Urban Agriculture in South East Asia
SW	Solid Waste
TLV	Traditional Leafy Vegetables
UA	Urban Agriculture
UK	United Kingdom

UMP	Urban Management Programme (UN-HABITAT)
UNCHS	United Nations Centre for Human Settlements
UNDP	United Nations Development Programme
UN-HABITAT	United Nations Human Settlements Programme
UNEP	United Nations Environment Programme
UNR	Universidad Nacional de Rosario (Argentina)
UPA	Urban and peri-urban agriculture includes both intra and peri-urban agriculture (UPA and UA are used interchangeably in this book)
UPE	Urban Poverty and Environment Programme Initiative (IDRC)
UPH	Urban and Peri-urban Horticulture
UVPP	Urban Vegetable Promotion Project (Tanzania)
VFPC	Vancouver Food Policy Council
VUFA	Vukuzenzela Urban Farmers Association
WHO	World Health Organization
WTP	Willingness to Pay
WWTR	Wastewater Treatment and Reuse

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The Cases

Chapter 2

Optimisation of the Use of Vacant Land in Rosario
(Appeared under the same title in UA Magazine no. 11: Availability, Access and Usability of Land for Urban Agriculture, December 2003)
Summary by **Marielle Dubbeling** based on project documents elaborated by:
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Multifunctional Land Use, Promoting Urban Agriculture in Europe
(Slightly adapted version, appeared under the same title in UA Magazine no. 04: the Integration of Urban and Peri-Urban Agriculture into Planning, July 2001)
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Urban Agriculture and Sustainability in Vancouver, Canada
(Shortened version of the contribution to the World Urban Forum, June 2006)
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Chapter 3

Land Availability for Urban Agriculture in Abidjan, Cote d' Ivoire
(Synthesis of a study undertaken by IAGU under the RUAF Programme in 2003 under the title "The Issue of Availability of Land for Urban Agriculture, a case study of Abidjan, Cote d' Ivoire")
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Peri-urban Agriculture Development in China
(Appeared under the same title in UA Magazine no. 09: Financing Urban Agriculture, April 2003)
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Chapter 4

Focusing credit on urban agriculture in Gaborone, Botswana
(Appeared under the same title in UA Magazine no. 09: Financing Urban Agriculture, April 2003)
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Securing Funds through Municipal Participatory Budgets: the experience of Porto Alegre, Brazil
(Appeared under the same title in UA Magazine no. 09: Financing Urban Agriculture, April 2003)
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Credit and investment in urban agriculture in Nepal
(Appeared under the same title in UA Magazine no. 09: Financing Urban Agriculture, April 2003)
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Chapter 5

India's Collaborative Market Access Initiative
(Appeared under the same title in UA Magazine no. 12: Gender and Urban Agriculture, May 2004)
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Peru's Resources for Development Association
(Appeared under the title "When the Women Decided to Work the Gardens" in UA Magazine no. 12: Gender and Urban Agriculture, May 2004)
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Senegal's Cooperative Movement
(Appeared under the same title in UA Magazine no. 12: Gender and Urban Agriculture, May 2004)
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Chapter 6

The Siyazama Community Allotment Garden Association, Cape Town, South Africa
(Adapted version of the article that appeared under the title "Learning from the Cape Town Flats Townships" in UA Magazine no. 06: Transition to Ecological Urban Agriculture, April 2002)
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Project 'Patio Comunitario': a community initiative to produce sustainable food
(Adapted version of the article that appeared under the title "Community Backyard Farming in Cuba" in UA Magazine no. 06: Transition to Ecological Urban Agriculture, April 2002)
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Economic Impacts of Urban Agriculture in Peri-urban Beijing
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PROVE – Small Agricultural Production Verticalisation Programme
(Slightly adapted version, of the article that appeared under the same title in UA Magazine no. 05: Appropriate Methods for Urban Agriculture, December 2001)
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Income Generated by Farming Systems around Kumasi
(Appeared under the same title in UA Magazine no. 07: The Economics of Urban Agriculture, August 2002)
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Chapter 8

Planning in a Changing Environment: The Case of Marilao in the Philippines
(Appeared under the same title in UA Magazine no. 04: the Integration of Urban and Peri-Urban Agriculture into Planning, July 2001)
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Container Composting in Peri-urban Kumasi, Ghana
(Adapted version of the article that appeared under the title "Container Composting in Peri-Urban Kumasi, Ghana" by Bradford, A. McGregor, D. and Simon, D. 2003 In Urban Agriculture Magazine, 10: Micro-Technologies for Urban Agriculture, August 2003).
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Community-Based Compost Production for Urban Agriculture in Nairobi
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Chapter 9

Adaptations of Wastewater-irrigated Farming Systems: A Case Study of Hyderabad, India
(Appeared under the same title in UA Magazine no. 08: Wastewater Use for Urban Agriculture, December 2002)
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The Use of Polluted Water in Urban Agriculture: "Livelihood realities and challenges"
(Appeared under the same title in UA Magazine no. 08: Wastewater Use for Urban Agriculture, December 2002)
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Wastewater Treatment and Reuse for Food and Water SecurityWastewater Treatment and Reuse for Food and Water Security
(Appeared under the same title in UA Magazine no. 08: Wastewater Use for Urban Agriculture, December 2002)
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Chapter 10

The Farmer Field School (FFS) method in an urban setting: a case study in Lima, Peru
(Written by the authors for this book)
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Situation analysis and health risk assessment: Cattle and poultry raising in Kampala
(Written by the author for this book; based on Nasinyama et al 2004; Randolph et al, Forthcoming and Dimoulas and Walner-Toews, forthcoming)
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Integrated urban management of local agricultural development: the policy arena in Cuba
(Written by the author for this book; based on findings of especially Cruz and Medina, 2003 and Novo and Murphy 2000)
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Dry and aquatic periurban and urban horticulture in Hanoi, Vietnam
(Written by the authors for this book)
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Horticulture in Dakar, Senegal
(Written by the authors for this book)
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Micro-technologies for Congested Urban Centres in Ethiopia
Adapted version of two articles by the same author that are earlier published in the UA Magazine no. 06: Transition to Ecological Urban Agriculture; a Challenge; and no. 10: Micro-Technologies for Urban Agriculture, August 2003.
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Vegetable production in Yaoundé, Cameroon
(Written by the authors for this book)
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Chapter 12

Market-oriented Urban and Peri-Urban Dairy Systems
(Appeared under the same title in UA Magazine no. 02: Livestock in and Around Cities, October 2000)
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Yoseph Mekasha
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Grazing Animals as Park Managers? using animals in the management of urban green areas
(Appeared under the same title in UA Magazine no. 13: Trees and Cities Growing Together, December 2004)
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Urban pig farming in irregular settlements in Uruguay
(Appeared under the same title in UA Magazine no. 02: Livestock in and Around Cities, October 2000)
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Aquatic Food Production Systems in Bangkok
(Appeared under the same title in UA Magazine no. 14: Urban Aquatic Production, July 2005)
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The Use of Treated Sewage Water from Settlement Ponds in San Juan, Lima
(Appeared under the same title in UA Magazine no. 14: Urban Aquatic Production, July 2005)
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Planning for Aquatic Production in East Kolkata Wetlands
(Appeared under the same title in UA Magazine no. 14: Urban Aquatic Production, July 2005)
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Chapter 14

Urban Forestry in China: Status and Prospects
(Appeared under the same title in UA Magazine no. 13: Trees and Cities Growing together, December 2004)
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Agroforestry in Periurban Cities of Abia State, Nigeria
(Appeared under the same title in UA Magazine no. 13: Trees and Cities Growing Together, December 2004)
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Bringing Town and Country Closer Together: Community Forests in North East England
(Appeared under the same title in UA Magazine no. 13: Trees and Cities Growing Together, December 2004)
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General Resources

Much has been published in recent years on urban agriculture and related subjects. For a comprehensive overview of the literature on urban agriculture the reader is referred to the RUAF website: www.ruaf.org that contains a searchable bibliographic database, partially with full document or abstract. In each of the next chapters some key publications and websites are given related to the subject of that chapter, as selected by the author of the chapter and the editor. Below some publications are listed that cover various aspects of urban agriculture and urban food systems.

Urban Agriculture: Food, Jobs and Sustainable Cities
Smit. Jac, Annu Ratta and Joe Nasr. 1996. UNDP, Habitat II Series
This is the first comprehensive publication on the subject. The book is based on exploratory trips made to over 20 countries in Asia, Africa and Latin America by staff of the Urban Agriculture Initiative of the UNDP.

Growing Cities, Growing Food: urban agriculture on the policy agenda.
Bakker, Nico; Dubbeling, Marielle; Guendel, Sabine; Sabel-Koschella, Ulrich; Zeeuw, Henk de (eds). 2000. Feldafing (Germany): DSE. 467 p.
This reader marks the beginning of the RUAF programme. It has contributed to the debate on the value of urban agriculture for sustainable urban development. It contains thematic articles and case studies from selected cities in Asia, Africa, Latin America and Europe.

For Hunger-Proof Cities: Sustainable Urban Food Systems
*Koc, Mustafa, Rod MacRae, Luc J.A. Mougeot, and Jennifer Welsh (Eds.) 1999. I*DRC. ISBN 0-88936-882-1. 252 pp.
This book examines food security from an urban perspective. It discusses existing local food systems and ways to improve the availability and accessibility of food for city dwellers, considering methods of analysis, and marketing and distribution structures.

AGROPOLIS, The Social, Political, and Environmental Dimensions of Urban Agriculture
Mougeot, Luc J.A. 2005. Earthscan/IDRC. ISBN 1-55250-186-8. 308 pp.
The initial findings of the original field research projects funded by IDRC's AGROPOLIS International Graduate Research Awards on Urban Agriculture are presented in this book.

Alternative Urban Futures, Planning for Sustainable Development in Cities throughout the World
Pinderhughes, Raquel. 2003. Rowman and Littlefield Inc, forthcoming December 2003.
This publication explores the approaches and appropriate technologies that can be used in five critical areas: water, waste, energy, transportation, and food systems.

Urban Agriculture
This video on urban agriculture, produced by ETC-RUAF with AV2, has been translated into six languages and is available on video and cd-rom. It consists of two parts. The first part describes the different forms of urban agriculture and the potential contribution of each of them. The second part presents three examples of local processes of policy development and planning for urban agriculture.

The Peri-Urban Interface, a tale of two cities.
Brook, Robert and Julio Dávila (eds.). 2000. School of Agricultural and Forest Sciences, University of Wales and Development Planning Unit, University College London.
The publication describes urban agriculture by comparing the cases of two cities: Kumasi in Ghana and Hubli-Dharwad in India. It covers interesting aspects of methodologies (for instance defining the peri-urban interface and livelihoods) and provides good case analysis of different problems and opportunities, also in relation to urban agriculture.

Urban-Rural Linkages: an annotated bibliography 1994-2004
UN-HABITAT. ISBN: 92-1-131713-4
This bibliography brings together references on published materials as well as grey literature.

www.ruaf.org
The website of the Resource Centre on Urban Agriculture and Food Security contains information on the international partnership programme, links, a searchable bibliography and resource guide on urban agriculture, recent publications, and the Urban Agriculture magazine.

www.idrc.ca
The International Development Research Centre (IDRC) website provides extensive coverage on the research programmes and projects supported by IDRC. IDRC's Cities Feeding People Programme can be found at http://www.idrc.ca/cdf, and is among the most prominent ones on urban agriculture.

www.cityfarmer.org
This long-running and well-known website is an important clearinghouse for descriptions, research and opinions on community-based urban agriculture projects and practices.

www.cipotato.org/urbanharvest
In late 1999 the CGIAR launched a system-wide initiative to direct and coordinate the collective knowledge and technologies of the Future Harvest Centers towards strengthening urban and peri-urban agriculture. The Initiative, formerly known by its acronym SIUPA, is renamed Urban Harvest and has been involved supporting and implementing research and development projects in regional settings, as well as in alliance-building initiatives at global and regional level.

www.iied.org
The Human Settlements Programme of the IIED works to reduce poverty and improve health and housing conditions in the urban centres of Latin America, Asia and Africa. The Programme seeks to combine this with promoting good governance and ecologically sustainable patterns of urban development.

www.fao.org
The Priority Area for Interdisciplinary Action on Food for the Cities covers a wide array of technical areas, which can be found on the different pages of the departments involved.

www.ucl.ac.uk/dpu/pui/
This is the website of the Peri-urban Interface Project, "Strategic Environmental Planning and Management for the Peri-Urban Interface", of the University College London.

www.developmentgateway.org
The Development Gateway Foundation, through its website, puts the internet to work for developing countries under the motto, "connect, collaborate and change your world".

www.leisa.org
This is the website of ILEIA (Centre for Information on Low-External-Input and Sustainable Agriculture) with information on successful experiences of agro-ecological approaches and the *LEISA Magazine.*

www.foodsecurity.org
The Community Food Security Coalition (CFSC) is a non-profit, North American organisation dedicated to building strong, sustainable, local and regional food systems. CFSC has over 325 member organizations. The site offers a wealth of experiences.

www.communitygarden.org
The American Community Gardening Association (ACGA) is a bi-national nonprofit membership organisation of professionals, volunteers and supporters of community greening in urban and rural communities. The site provides practical information, but also seeks to facilitate social interaction and self-reliance, beautifying neighbourhoods, and producing nutritious food.

RUAF

The central aim of the RUAF Foundation (the International Network of Resource Centres on Urban Agriculture and Food Security) is to contribute to urban poverty reduction, urban food security, improved urban environmental management, empowerment of urban farmers and participatory city governance by enhancing policy awareness on benefits and risks of urban agriculture, capacity development, facilitating local policy formulation and action planning on urban agriculture, and promoting networking and exchange of experiences. The RUAF – Cities Farming for the Future programme (2005-2010) is executed by the seven regional RUAF partners in co-ordination with ETC Urban Agriculture (see next page for information) in 20 pilot cities and 48 dissemination cities. In the pilot cities, the partners are implementing the following main strategies: Local capacity development, Facilitation of multi-stakeholder policy development and action planning, Knowledge management and networking, Establishment of monitoring systems on urban agriculture, and Gender mainstreaming. More information is found on www.ruaf.org.

International Development Research Centre

Canada's International Development Research Centre (IDRC) is one of the world's leading institutions in the generation and application of new knowledge to meet the challenges of international development. For more than 30 years, IDRC has worked in close collaboration with researchers from the developing world in their search for the means to build healthier, more equitable, and more prosperous societies. www.idrc.ca.

International Institute of Rural Reconstruction

The International Institute of Rural Reconstruction (IIRR) works with the rural poor in developing countries to improve their lives by building on their unique assests and strengths. IIRR achieves this through field research, training, publications and filed programs with poor communities and in partnership with other development organizations. Rural reconstruction is a development strategy first advanced by Mass Education and Rural Reconstruction Movement founded by Dr. Y.C. James Yen in 1923. The strategy is sustainable, integrated and people-centered. IIRR is a recipient of various awards in recognition of its contributions to development. Among these is the Alan Shawn Feinstein's 1995 World Hunger Award in recognition of "IIRR's exceptional work to provide opportunities for small rural farmers throughout the developing world to prevent and reduce hunger and malnutrition in their communities." IIRR has also received the prestigious Ramon Magsaysay Award for International Understanding, an award considered to be the "Nobel Prize of Asia. www.iirr.org.