URBAN AGRICULTURE MAGAZINE
NUMBER 7, AUGUST 2002
www.ruaf.org

These women sell part of their produce at the market of Los Chillos

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The Economics of Urban Agriculture

Urban agriculture provides multiple functions and benefits to urban dwellers and cities. Political support is growing and further research and financial support to enhance the contribution of urban agriculture to sustainable urban development is necessary. In this issue of the *UA-Magazine* we focus on the analysis and understanding of the economics of urban agriculture, during periods of economic recession as well as in times of a well developing economy.

Editorial

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The Economics of Urban Agriculture is a wide area of study. Moustier (2001) discusses the following indicators to show and measure the economic impacts of urban agriculture: employment (population involved), income and income distribution, cash readiness, contribution to household food, added value, contribution to urban food supply, and share in market(s). Various case studies are presented in this issue analysing such factors at household and/or municipal level. Next to the analysis of the socio-economic impacts of urban agriculture, strategies to further develop the economic contribution of urban agriculture are presented and reviewed.

Rapid urbanisation in developing countries and migration of rural populations places high demand on cities to provide jobs and adequate living conditions. The numbers of urban poor and those operating in the informal sector are increasing throughout Africa, Asia and Latin America, and many of them incorporate agriculture as part of their livelihood strategies. Although the contribution of urban agriculture to the GDP (Gross Domestic Product) may be small, its importance to many city inhabitants is substantial, especially in difficult times (see the Buenos Aires, Quito and Harare case studies).

Urban agriculture arises not only out of crisis situations, but also exists because of nearness to urban markets and the comparative advantages this location provides for delivery of fresh perishable products as milk (Nairobi), eggs, meat and fresh vegetables (Kumasi), the availability of productive resources (water, compost of urban organic wastes), closeness to institutions providing credit, technical advice and market information, etc. Urban agriculture complements rural agriculture and increases the efficiency of the national food supply in terms of producing niche products, or may substitute food imports (leading to foreign exchange savings). The contribution to urban food supply varies, relative to rural agriculture, depending on product and season (see Ouagadougou). When the economy improves urban agriculture also may take on other functions for the urban citizens: gardening for leisure and physical exercise, offering of recreational services

Income of Farming Systems Around Kumasi
Market proximity is a major incentive for the intensification of farming systems or change of systems to more profitable ones. A common example is the production of perishable products, such as vegetables in urban and periurban areas. Around Kumasi, many rainfed maize-cassava farmers 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 water access for irrigation.

to urban tourists, maintenance of the periurban landscape and biodiversity and reduction of the urban ecological food print (as explained in the London case).

Nugent (2001) suggests the following key questions concerning the socio-economic impacts of urban agriculture in economic analysis:

- Who are the important stakeholders, and how do they relate?
- What are the impacts of urban agriculture on the community, and why are these impacts positive or negative, temporary or permanent, and how do they change over time?
- Are these impacts on the community better (overall) than other uses of space, and how can choices be made about alternative uses?
- How do factors outside the community relate to the community and urban agriculture?

ECONOMIC IMPACTS OF URBAN AGRICULTURE

In the Special issue of the *UA-Magazine* on ***food security***, prepared for the FAO World Food Summit-five years later and available at **www.ruaf.org**, the impact of urban agriculture on the nutritional status of households is given for a number of countries, showing that producing for household consumption raised food security and provided them with a healthier diet than those without access to crop and livestock production. Self-produced food represents anywhere from 18 percent (Jakarta) to 60 percent (Harare) of total food consumption in low-income households, while studies in two slum areas of Nairobi found very high benefits from urban farming including: at least 50 percent of food consumed derived from the farmers own production (*UA-Magazine* Special, 2002, Mwangi, 1995).

The food produced often represents important ***savings on food expenditures.*** Poor urban consumers can spend 60 to 80 percent of their income on food. Self-production of food makes little cash income of the household available for other expenditures. Furthermore, improved access to food and income positively affects people's ***capacity to work*** and invest. The article on Ouagadougou in this issue shows that the positive economic impact and food security for the cultivators weighed up against the risks of practising home gardening, but that the level of these benefits depend on seasonal variations and external factors

Urban agriculture creates ***self-employment*** and ***income***, especially for the urban poor lacking access to other jobs and as a complementary source of income to low and middle income households. Income earned by urban farmers is found to a significant, but an often uncertain, contributor to household maintenance. In Dar Es Salaam, Tanzania, urban agriculture is the second largest employer (20 percent of those employed, Sawio, 1998). In Nairobi, Kenya Urban agriculture provides the highest self-employment earnings in small-scale enterprises and the third highest earnings in all of urban Kenya (House et al., 1993). In Lomé the mean monthly income of a market gardener was found to equal ten minimum salaries or that of a senior public servant (Abutiate, 1995).

Nugent (2000) describes the factors influencing net income of a household as: the *farming effort* (type of activity, amount of time spent, etc); the *availability* and *cost of basic inputs*; the *yields*, which are determined by *management* and *available technology*; *access to market* or other buyers and subsequent *prices* obtained, which in turn depend on cash needed, ability to store, process and preserve products, and on *outside fa*ctors such as supply and demand of the products. The cases on Kumasi, Nairobi, Mexico D.F. and Ouagadougou in this issue demonstrate that urban farmers made rational production decisions by taking up higher risk intensive vegetable production (Kumasi), or obtaining better returns per dollar invested by maintaining diversity and using fewer external inputs (Mexico). These cases also show the importance of the use of local resources and its positive impact on the economies of small-scale farmers in a periurban setting.

In Africa, Latin America and Asia, especially ***women*** are active in urban agriculture, seeking improved diets for their families and/or additional income. For many women, urban agriculture provides an attractive and flexible alternative to badly paid wage labour in households and other informal jobs far away from their houses (with related costs of bus fares and people tending their children). In order to understand the role of urban agriculture in the ***survival strategies of poor urban households***, various factors must be analysed. Urban agriculture can have an important positive economic impact on urban households, but very often as part of a broader array of strategies. As the examples of Ouagadougou and Haroonabad in this issue illustrate, there is relatively little use of ***wage labour*** in urban agriculture production, with exception of the peak periods.

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Employment is also created by the ***small scale enterprises*** producing inputs for agricultural production (e.g. production of compost, equipment, a.o.) or processing and marketing agricultural products (packaging, frying, drying, canning, freezing, marmalades, etcetera). Examples of the former are given in this issue ion the use in periurban agriculture of urban organic wastes in Brisbane and of urban wastewater in Nairobi and Haroonabad. Examples of the latter in this issue, are the contributions on Fortaleza, Buenos Aires and Quito, and the discussion on London.

Urban agriculture provides the urban poor with a ***good buffer against sectoral shocks*** (Nugent 2000), in that one can start the activity with relatively few barriers (although lack of land ownership in many cases prevents substantial investment) and provides food, which is the most essential commodity in times of economic crisis (illustrated by the cases on Ouagadougou, Harare and Fortaleza).

The fact sheet included in the Special edition of the *UA-Magazine* on food security shows that the quantities of vegetables, poultry, milk, eggs, etcetera, annually produced in/around the cities are quite substantial (see also several articles in this issue: Kumasi, Nairobi, Havana and Ouagadougou). The few data available on the ***market value of the products*** generated in urban agriculture are impressive.

In Dar Es Salaam, Tanzania, urban agriculture is the second largest employer (20 percent of those employed). The individual urban farmer's annual average profit was estimated at 1.6 the annual minimum salary (Sawio, 1998). In Accra, Ghana nearly 30% of low-income households in informal housing, had livestock worth on average nearly a full month of income. In Hanoi, Vietnam it is estimated that 80% of fresh vegetables, 50% of pork, poultry and fresh water fish, as well as 40 % of eggs, originate from urban and periurban areas (*UA-Magazine* Special, 2002).

ECONOMIC VALUATION AT CITY LEVEL

It is not that simple to determine the economic value of agricultural production in and around the cities based on hard "cost and benefit" data. Data on the amounts of inputs used or their prices, the quantities of food produced and prices obtained within the city boundaries are often lacking or not accurate and difficult to obtain due to the largely informal character of urban agriculture.

It is often argued that economically more valuable land uses will (or even should) replace urban agriculture. High urban land values are clearly a main factor influencing urban agriculture and in an open market agriculture often gives way to industry, housing, etcetera. However, the economic power of intensive horticulture and animal husbandry is often underestimated and the picture regarding the ***economic value*** of urban agriculture becomes much more positive if ***non-market benefits*** (such as food security, better nutrition and social integration of the poor, urban greening and better urban micro-climates, recycling of urban organic wastes, urban landscape management, recreation, etc.) are included and urban policies are implemented that support such functions of urban agriculture.

In order to estimate the non-market costs other methods to estimate cost-benefits of urban agriculture, e.g. the contingency value method (Henn and Henning 2001, Nugent 2001) that take into account the social, health and environmental costs and benefits, by using opportunity costs and willingness to pay as measurements.

The cases in this magazine issue illustrate that more multidisciplinary work is needed in order to produce clear data that convince policy makers about the socio-economic importance of urban agriculture and alternative ways to support urban agriculture.

MEASURES TO STRENGTHEN THE ECONOMIC IMPORTANCE OF URBAN AGRICULTURE

Once a Municipality acknowledges the importance of urban agriculture, various measures to stimulate the development of this sector can be considered, including:

- the establishment of farmers' markets and related basic infrastructure (see the articles on the experiences gained in Buenos Aires and Quito in this issue)
- the stimulation of micro-enterprise development in food processing and

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Private Investment in Urban Agriculture in Nairobi

Urban agriculture constitutes a critical food security component of low-income urban farming families. Also, urban agriculture is an important aspect of urban agri-business where the sector generates important income and employment opportunities. Producers often lack access to efficient credit and investment support services. Agro-based industries in Nairobi play an important role in the promotion of urban agriculture, which can be enhanced by an organised farmers society and favourable government policy environment.

marketing (see the articles on Fortaleza and Nairobi)

- ❖ Improving access of urban farmers to credit services and technical advice (see page 4 and the article on Quito – "Credit and investment for urban agriculture" will be the focus in issue no. 9 of the *UA-Magazine)*
- ❖ Stimulation of the transition from subsistence to market oriented urban farming can be stimulated, among others by provision of market information regarding most promising niche markets for urban agriculture like fresh vegetables (Kumasi), ornamentals (Buenos Aires), flowers and hydroponics (Brisbane) and assisting urban farmers to engage in such sectors.

Municipal policies should address urban agriculture holistically, as part of the entire urban food system, covering different sectors (food security, environment, health, land use, etc.), and at different levels (local and national). Municipalities try to reduce the number of urban poor and promote their social integration in the urban economy, while many national level policies tend to push people into the informal sector. Thus, there is an important role to play for the municipality in the enhancement of urban agriculture. But also investment of the private sector may play a substantial role as the Harare and Nairobi cases show.

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Maximizing Private and Social Gains of Wastewater Agriculture in Haroonabad

In many low-income countries, municipalities often lack necessary physical, financial, institutional and regulatory means to safely dispose-off wastewater. On the other hand, the farmers around urban and periurban areas find wastewater as a valuable resource to grow high value crops. This paper presents data from a case study from Pakistan's southern Punjab, and estimates private and social gains from wastewater agriculture and compares these to the freshwater agriculture.

Micro-Credit and Investment in Urban Agriculture

Urban Agriculture has been recognised in many cities to be a vehicle for urban environmental improvement, and for strengthening the development of productive, sustainable and democratic cities. Examples have been covered in earlier issues of the *UA-Magazine* (see the article on Dar Es Salaam, Santiago de los Caballeros and Gaborone in issue no.4 on the *Integration of Urban Agriculture into City Planning*). Both financial and political legitimacy are essential to support this development and the scaling-up of positive experiences. Progress has been recorded and assessed on political support rather than on the financial one, despite a growing interest of development and financial agencies.

Therefore, a systematic survey and evaluation of significant and diverse modalities of credit and investment provision to urban agriculture is very timely. In the past two decades, considerable progress with several types of micro-financing has been made (like cooperative banking, micro-banks, village banks and solidarity groups), but further institutional innovation is required. This is especially so for urban agriculture. The growth of this 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 under-utilised urban resources.

UN Habitat through its Urban Economy and Finance Branch (at Headquarters in Nairobi) and its Urban Management Programme for Latin America and the Caribbean (UMP-LAC), as well as the International Development Research Council (IDRC), decided to support a global initiative to promote a more coherent and efficient development and implementation of credit and investment schemes for urban agriculture innovations. The initiative, which started in early 2002, aims to identify, typify, analyse and draw lessons from seven major city case studies in Kathmandu and Bharatpur, Nepal; Bangalore, India; Khartoum, Sudan; Gaborone; Botswana; Quito, Ecuador; Texcoco, Mexico; and one London, UK. Additional case studies are supported by UMP and RUAF. The experiences will be systematised and compared in a Fact Sheet and synthesis paper, which will be distributed widely through various channels, and presented in issue no.9 of the *UA-Magazine* (due in March 2003).

At the conference "Food Security in African Cities" (27-31 May 2002, in Nairobi, Kenya) organised by UN-HABITAT, FAO, IDRC and SIUPA-CGIAR, a workshop was held to discuss early drafts and develop policy recommendations for improving the financial, social and institutional sustainability of such systems. The cases were assessed according to Actors, Type of Investment, Interest rate, Type of activities supported, Scale of scheme, Strengths and Weaknesses, Policy Response and Recommendations.

Next to the importance of credit and investment for urban agriculture, especially for women and youth, recommendations were presented regarding *financial sustainability* (e.g. flexible terms and interest rates and the need for monitoring and quality control), *institutional sustainability and partnerships* (involvement of public and private investment, diversification of portfolios of providers of resources) and *governance of the schemes* (participation of beneficiaries, clear policy rules, proper management and transparency).

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IWMI

Irrigating urban vegetables with cans

Income of Farming Systems around Kumasi

Vegetable farming is for income generation

These systems are not only output intensive - with for example up to eleven 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.* 2002). But what are the benefits of farming with insecure tenure, high risk of pest attacks and much more dependency on in- and output market fluctuations than ever faced in traditional maize and cassava farming in rural Kumasi? The motivation to start urban vegetable farming is in fact largely economic, which is the subject of this article.

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KUMASI

This study was carried out in urban and periurban areas of Kumasi. The periurban area of Kumasi extends on average 40 km from the city center (Adam 2001). Vegetable farmers in urban Kumasi have informal land arrangements with the authorities or private owners and do not pay rent on the land. The essence is to keep the area clean and to prevent encroachment by squatters. Periurban or rural farmers, on the other hand, hold short-term (e.g. two year) renting or leasing agreements with the chief of their community for the traditional maize-cassava intercropping system.

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 or cauliflower. Urban vegetable farmers cultivate all of these crops year-round, mostly with manual irrigation, and vary crops according to their own specialisation and market demand. In periurban Kumasi, farmers still rely on traditional and largely subsistence maize and cassava rainfed farming. Close to streams or where shallow wells can be dug, many farmers start dry-season cultivation of, for example, okra, tomatoes, peppers, or cabbage for the urban market. Besides access to water, dry season vegetable production depends on a good road network.

FINANCIAL ANALYSIS

Surveys carried out by the Kwame Nkrumah University of Science and Technology (KNUST) with International Water Management Institute (IWMI) as well as different British research teams covered in total about 300 farm households. Cost-benefit analysis comparisons were made of farm finances of common rural (A), periurban (B/C) and urban farming (D) systems see table 1 (i.e., traditional maize-cassava farming, additional dry-season vegetable irrigation, and open-space year-round urban vegetable farming, respectively).

Urban and periurban farmers use water from streams and drains and dugout wells and only in selected cases, pipe-borne water. In the urban areas, farmers use watering cans whilst periurban farmers often use either pumping machines or carry water from the stream to their farms. Manual irrigation needs to be carried out with high frequency and makes irriga-

Table 1. Revenue generated in different farming systems

Farming system	Typical farm size (ha)	Net revenue (US$)/ha/year	Net revenue (US$)/ farm holding/year
A Rainfed maize or maize/cassava	0.5-0.9	350-550	200-450
B Dry season vegetable irrigation *only* (garden eggs, pepper, okra, cabbage)	0.4-0.6	300-350	140-170
C Dry-season, irrigated vegetables and rainfed maize (or vegetables)	0.7-1.3	500-700	300-500
D All-year round irrigated vegetable farming (lettuce, cabbage, spring onions)	0.1-0.2	2,000-8,000	400-800

tion time-consuming and expensive (13% of total cost – excluding family labour – and 38% of time). Only weeding was rated as more expensive by the farmers (23% of total cost). The cost for hiring of 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).

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 fertiliser in addition to this (mostly for cabbage). In periurban Kumasi, many more vegetable farmers use mineral fertiliser (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 produce crops for them to sell. Sometimes the sellers order products ahead of time in an oral contract that is based on trust. The amount of money finally received may differ from the earlier agreement as demand and supply might have changed during the growing period. In the periurban area, wholesalers pick up vegetables either at assembly points or roadsides or at the farm gate, although some farmers closer to the city also bring their produce to urban wholesale markets.

Vegetable farming in the study area is for income generation. Urban farmers occupying open space in low- or bottomlands crop all year round and reach annual income levels of US $400 to $800 (see Table 1); this is 2-3 times the income they could earn from rural farming. However, being successful in this way requires careful observations of market demand. As urban farming is land and labour constrained, typical farm sizes range around 0.1 ha. Urban farmers thus earn at least twice as much as rural farmers on only about 20% of their farm area. Unfortunately, many cities do not offer much space for such intensive systems. In Kumasi, an area of only about 120 ha is currently under open space vegetable farming without considering about 80,000 backyard farms in the city which mostly produce for home consumption (i.e., to reduce expenditures on food).

For periurban farmers, dry season vegetable irrigation can also add a significant amount of cash to their income; especially as large parts of their rainfed 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 (e.g. tomatoes in the Akumadan area). There are three reasons for this: the importance of maize and cassava for home consumption (mentioned by 52% of the farmers interviewed); the lower price of vegetables in the rainy season (40%); and the increased risk of pest attacks (8%).

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 remarkable step over the poverty line. In 1998/99, about 43% of the Ghanaian population could be defined as poor, using the upper poverty line of 900,000 cedis (equivalent to about US $380 in January 1999) per adult per year (Ghana Statistical Service 1999). This part of the population has insufficient income to cover its essential food and non-food consumption. Twenty-nine percent even fall under the lower (i.e., extreme) poverty line of 700,000 cedis (ca. US $300) and cannot meet their caloric requirements even if they spent their entire budget on food. The common picture, that poverty is much higher in rural (52%) than urban areas (28%), finds its pendant in agriculture. Urban vegetable farmers thus jump over the poverty line, periurban vegetable farmers can double their staple crop income and move over the poverty line as well, while many maize-cassava farmers remain below it. However, ranked according to profit as a percentage of production costs, vegetable farming shows its disadvantage: high profits also require more investments and initial capital.

TRADE-OFFS

Urban vegetable farmers in particular obtain relatively high profits on a very small area as compared with the other farming systems. Additional benefits for the society (food supply, employment, trader income, etc.) must however be compared with the negative trade-offs, for example from pesticide use or through soil nutrient mining. Nevertheless, parallel nutrient balance studies by IWMI showed that related costs are low and are more significant in traditional farming (up to 10% of net income) than in intensive vegetable production (up to 1%).

Traditional cropping is based on ash (and soil) nutrient depletion, which the farmer is trying to counteract through shifting cultivation (acquiring new land). In irrigated urban vegetable farming, space limitations do not allow for shifting cultivation. Here, output-oriented cash crop production depends on high nutrient inputs to cope with low native soil fertility. On sandy soils, urban farmers enter into a vicious cycle of applying high rates of nutrients (especially N and K) which keep leaching out due to high rates of irrigation. Though, the irrigation water also contains nutrients, and as poultry manure is very cheap, costs remain low (Drechsel *et al.* 2002).

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Municipal Strategies for the primary sector of the District of Moreno, Buenos Aires

The horticultural and ornamental plant production sector of the district of Moreno, in Buenos Aires, is strategically located in an urban area with direct access to the major markets of the country. Horticultural producers predominantly belong to the Bolivian colony, with scarce income. Growers of ornamental plants are mostly from the Japanese (herbs) and Italian (trees and shrubs) communities, who are capable of undertaking larger capital investments.

The district of Moreno is located on the western edge of the Metropolitan Area of Buenos Aires, Argentina, 37 km from the federal capital. The district is divided into six localities: Moreno, La Reja, Francisco Alvarez, Cuartel V, Trujuy, and Paso del Rey. It covers 186.13 km², with a population of 430,000 residents as of 2001 (Population Census 2001). The strategic location of the municipality at the boundary of the metropolitan area and good infrastructure are factors that have a favourable effect on economic development. Using the railroad services or the western highway takes only 30 minutes to reach the centre of the capital, while the Caminos del Buen Aire Highway allows direct access to the other main productive corridors of the country.

The extension of the district and the availability of low-cost and easily accessible land make the district a privileged area for the development of urban projects (private neighbourhoods, estates) and consumption and leisure services.

In 1997, the Municipality of Moreno began a relationship with the productive sector through PROINSER (Programme of Incentives for the Rural Sector), which allowed the establishment of the Association of Horticulturists. In 1999, the Municipal Institute for Local Economic Development (IMDEL) was established as a new management and development tool of the state for the community. The main goal of IMDEL is to generate development policies for the district, taking into account that the primary sector is a source of labour and has significant economic movements in Moreno and the province in general. As a result, it was decided to enhance the producer-state relationship.

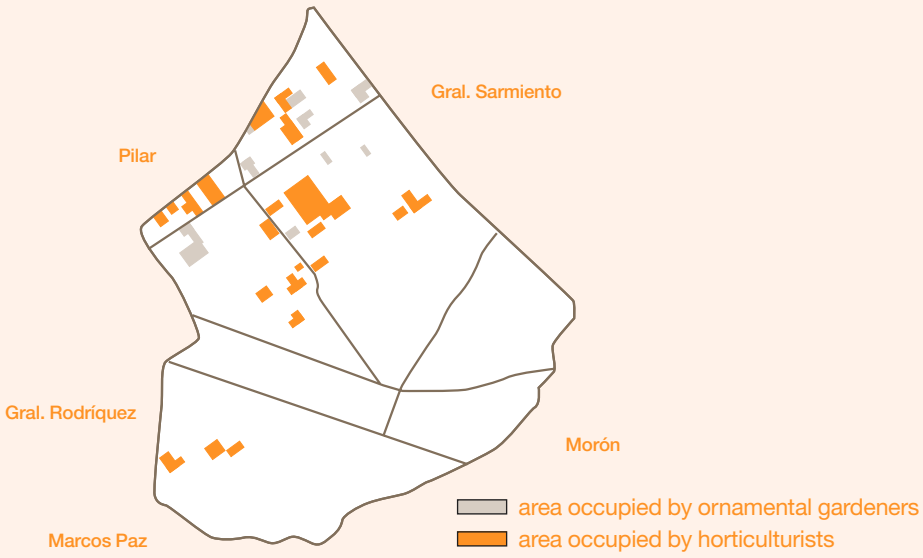

Figure 1: Urban agriculture zones in Partido de Moreno

THE HORTICULTURAL SECTOR

Horticultural facilities in the area are small - on average 6 ha. Some 40 species are grown throughout the year. Leafy vegetables are the most significant, being grown by 96% of producers and taking up a surface that accounts for 55% of the total horticultural area, followed by fruit, grown in 85% of all establishments and covering a surface equivalent to 32%. The total volume of production of the district reaches 3,663 annual tons, of which 90% are leafy vegetables and fruit (Horticultural Census 1998).

Labour is domestic (mostly of Bolivian origin), women and young people usually work the land while the men handle commercialisation aspects. Men, then again, learnt to work the fields from Portuguese growers living in adjacent lots. Most properties are rented; however, in many cases tenants do not have contracts to certify this status. The good geographic location of these lands motivates their owners to speculate with their value. Owners do not consider land exploitation as a way to obtain income but rather as a way to prevent the land from being illegally occupied. This means that the producers do not invest in improvements (greenhouse production, for instance), consolidating the precarious conditions and high health risks.

Most growers sell their produce through the Central Market of Buenos Aires (MCBA) or other regional markets, either directly or through consignees. The direct

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sale of vegetables in the area is also significant.

THE ORNAMENTAL PLANT PRODUCERS

The nursery sector is composed mostly of growers of flower seedlings, interior plants, cut flowers, perennial herbs, trees, and shrubs. The production surface of all these crops does not cover 100% of the total surface of the plot, because most are family-managed operations, a fact that is reflected in labour, the technology applied to the crops and the type and volume of production. According to the type of production (interior plants, trees and shrubs, etc.) one could say that the growers of seedlings have the highest demand for labour. These are mostly family undertakings and do not have sufficient labour available at all stages, and have to hire temporary labour (see Table 2).

Crop management and marketing are key aspects

Fifty percent of the annual production of seedlings originates in these areas, a fact that underlines the economic significance of this sector in Moreno and the country as a whole. Unlike the horticultural sector, land is owned by the producers, either through direct ownership or cession of use from parents to children. This situation guarantees that improvements are made whether through the addition of larger covered areas or the replacement of wood and glass nurseries with polyethylene ones (Barsky *et al.* 2001). Most growers sell their crops at the local market, while a very small number supplies hypermarket chains.

Most producers have been growing the same species for several years and, for them to adopt other species is in many cases equivalent to jumping into the void. In addition, the Japanese community has the support of the Japan International Cooperation Agency, JICA, which at the beginning financed the purchase of land and initial investments with loans granted at a very low interest rate. Currently JICA provides these producers with technical assistance in the management of crops, as well as in pest and disease control.

IMDEL STRATEGIES

IMDEL has a technical team in charge of growing ornamental plants, keeping orchards and recycling the pruning residues generated by the district, next to providing assistance services to growers.

They are not competitors in the market, because most of the production is used to plant squares, public parks, boulevards, and as urban greenery. In addition, the priority of the municipal nursery is to produce native trees, shrubs and herbs, which are not grown by anyone else in the district.

The work began with the organisation of meetings with groups of producers (horticulturists and nursery growers). This allowed creating new links among the producers themselves and at the same time offering the possibility of subsidising part of the temporary labour through the National Employment Emergency Programme (under which many were able to receive subsidies for local labour with the commitment of investing in their crops). Frequent visits were and are made to the plots, in order to determine existing difficulties and to guide growers in the search for solutions for problems that are common to the group.

Table 1 Inputs required for horticultural production

Production	Labour required	Use of agrochemicals
Leafy vegetables	Raking and harvesting	Only in summer crops
Fruits (Tomato, eggplant, zucchini)	Raking - staking - harvesting	During the entire process
Fruits (strawberry)	Disinfection of soil	During the entire process
	Application of black mulching	
	Pruning	
	Construction of tunnels	
	Harvest	

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The main goal of the horticulturists, who are already organised in an association, was to create a market. Projects were generated with the purpose of securing funds that would allow the creation of a fully serviced market for fruit and vegetables, including the processing and packaging facilities. This would allow them to sell their vegetables and fruit with higher added value. Although they were not able to obtain funds at first, the horticultural producers organised a cooperative for marketing, which resulted in the recently inaugurated Norchicha Market, where 80% of producers of the district are present.

Like the growers of ornamental plants, horticulturists had not been authorised because legislation only took into account industry and commerce. No distinction was made between agricultural producers and companies and impossible sums of money had to be paid for authorisation. Therefore, a Special Regime Ordinance for the promotion of the primary sector of Moreno was given. Hereby only those producers that exceed specified amounts pay the Tax on Security and Hygiene, and taxes increase proportionately to the income of the producers.

For many horticulturists, this ordinance had one added advantage: real leases could be obtained, which was a requirement for authorisation. Additionally, the IMDEL implemented a large-scale programme to prepare sacks of fruit and vegetables at a minimum cost to supply all the peripheral low-income neighbourhoods of the district. It installed a municipal programme under which fruit and vegetables from local producers were bought at first. This programme was able to prepare 30,000 sacks per week, with workers operating in three daily shifts. The sacks did not compete with local greengrocers, as most beneficiaries did not habitually eat vegetables and fruit.

Table 2 Inputs required for production of ornamentals

Production	Technology required	Labour	Use of agrochemicals	Crop rotation
Trees and shrubs	Latticework sheds to protect crop from low temperatures. Water quality control	3 persons /ha	Preventive and curative insecticides and fungicides	Low
Interior plants and perennial herbs	Greenhouses, climate control Water quality control Preparation of substrata for different species	5 persons/ha	Soil disinfectants Preventive and curative insecticides and fungicides	Inter-mediate
Seasonal seedlings	Greenhouses, climate control Preparation of substrata Water quality control	20 persons/ha	Soil disinfectants Preventive and curative insecticides and fungicides	High

The Institute established a consortium with nursery operators to allow them to sell their produce together with IMDEL (through tenders). Producers were organised in an Association of Flower Growers, Nursery Producers and Cut Flowers of Moreno, which organised the first "Expoferia de Productores", in September 2001. The goals of this event were to foster the consumption of ornamental plants and to publicise their activities as a production area. The group meets once a month, and the technical team contributes with information talks on issues requested by the producers.

In October 2001, the productive sector was seriously affected by a hailstorm that destroyed part of the crop. From then on, IMDEL began financing the producers who suffered most, with micro-credits granted through Banco Social Municipal at a 5% rate in pesos (at a time where no credits either in pesos or dollars were available in the country), which had to be paid within two years and with a joint guarantee among producers. In order to achieve this we developed an investment project for producers, and together Banco Social and the Association of Nursery Producers evaluated its feasibility. Once the money is reimbursed, it will be deposited in a special line to aid the primary sector of the district. Additionally, IMDEL obtained the exemption of provincial and local service charges for six months after the hailstorm.

CURRENT STATUS

IMDEL is currently working on the improvement of the quality of the vegetable crops through a series of research agreements with national universities. This will enable them to generate an adequate management plan for the producers, using fewer agrochemicals, potable water, and in the future the delivery of certifications of origin. Crop management of nurseries is tested with techniques that allow reducing the incidence of diseases and several alternatives in the use of Methyl Bromide as a soil disinfectant.

Crop management and marketing are key aspects in both sectors, especially at this point where sales in the country have been few for lack of money supply. Hence, productive activities must be more efficient and producers must assess new ways to sell and plan their crops, as many grow the same species and even the same varieties. In this sense, it is not easy to introduce changes in the planning of which species to grow and how, among those farmers who still have difficulties adopting simple daily management strategies.

Therefore, any productive planning must have a strong social and cultural component in the assessment of each case in particular.

In the future, IMDEL will try to prepare a Local Production Plan both for horticulturists and for nursery growers that takes into account the current status of the producers and defines strategies to improve their production and their quality of life, both quantitatively and qualitatively.

The state plays a key role in the development of urban agriculture, and it is very important to work in an interdisciplinary fashion with the various departments of the municipality, with other municipalities, with the provincial and national governments, and with the various agencies working in the region.

VIDEO on Urban Agriculture

2002. 45 min. VHS-PAL/SECAM/NTSC.
RUAF. The Netherlands

This video has been produced to facilitate a greater understanding of urban agriculture among policy-makers, urban planners, NGO's, and others, who can make a contribution to the integration of urban agriculture into urban polices, plans and development programmes. Produced by RUAF and AV2 Foundation, the video is supported by many organisations, like IDRC, CORDAID, NOVIB, NCDO, DSE/ZEL, ICCO, ASC, MISEREOR and GTZ. The first part of the video shows the potential contribution of urban agriculture to enhancing urban food security, poverty alleviation and sustainable urban management. Footage comes from Hanoi-Vietnam, Dakar-Senegal, Dar es Salaam-Tanzania and Cuenca-Ecuador. The latter two cities are used as examples in the second part of the video, which shows local processes of situation analysis, policy development, planning and action. The video is available in English, French, Spanish and Arabic.

Conjunto Palmeira is a slum with 30,000 inhabitants, situated in the southern area of Fortaleza-Cearà, a metropolis located in the northeast of Brazil. The first inhabitants arrived here in 1973 and started building their houses spontaneously, without access to purified water, electric power, schools or other public services. In 1981, the Association of Settlers of the Conjunto Palmeira (ASMOCONP) was founded, starting the process of organisation of the families

João Joaquim de Melo Neto Segundo

Breeding of caipira hens

Urban Agriculture Project

In the Conjunto Palmeira Slum, Fortaleza-Ceará, Brazil

Slowly, the Association of Settlers managed to develop the neighbourhood through popular mobilisation and partnerships with municipality and private companies. In 1988, potable water and electricity was installed. In 1990, through a partnership with the Prefect's Office, the State Government and GTZ (German Agency for Technical Co-operation), the neighbours collectively built a 1,700-meter long drainage canal. Again two years later, the Association organised the settlers by blocks and started the implementation of a sewage network with the help of the State Government. Through these achievements, the neighbourhood became more liveable.

In spite of these advances, a survey by the Association of Settlers in 1997 revealed that poverty and hunger were still devastating the residents of the neighbourhood: 80% unemployment, 90% of economically active households earning an income of less than two minimum wages (US$ 80) and difficulties in accessing loans and marketing of products, have prevented small enterprise development. Close to 1,200 children were roaming the streets, as there was no place for them in schools. Illiteracy rates in the community reached 75% of settlers.

In January 1998, ASMOCONP established the Banco Palmas and implemented a solidarity network among producers and consumers. The bank guarantees micro-credits for production and local consumption, at very low rates, without prerequisites like cadastral consultations, verification of income, or guarantees (collateral). Within a short period of time, the Banco Palmas had created several bodies to form a solidarity network, including the Local Producers' Fair, a Solidarity Shop, a Bartering Club for Social Exchanges, a Solidarity School, etc.

In October 2000, the Banco Palmas launched a programme called *Incubadora Femenina* (the women's hatchery), aimed at assisting women in the slum who lived in high-risk situations, who were generally illiterate and lacked professional training; e.g. heads of households, single mothers and drug users. The programme includes a food-security strategy, which guarantees a nine-month delivery of nutritional, psychological, medical follow-up and professional training. At the end of this period, each woman receives a loan from the bank that will be used to launch a productive undertaking in her home.

Fighting hunger with local development became the great challenge for Banco Palmas. Urban agriculture practices fit perfectly in the food-security strategies of Palmas, because in addition to providing food for consumption, the production surplus can be sold at the solidarity shop and at the neighbourhood fair, generating income for the families.

The bank did not have any previous experience with these practices. However, agricultural experience was available in the neighbourhood as most of its older inhabitants came from rural areas. Some settlers spontaneously started to raise livestock for their own consumption needs, such as pigs, goats and hens, kept in the houses or freely roaming in the streets of the neighbourhood.

Women were very enthusiastic about the development of an agricultural activity as they had a very close relationship with the fields.

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Table 1: Obstacles and the solutions offered to

Obstacles	Proposals of solutions submitted
- Varying property sizes, soil characteristics, groundwater aquifers and salinity levels, which make it difficult to adjust the projects	- For the project's agricultural technician to make a study to determine the type of practices that are achievable in each property
- Lack of walls around most backyards, permitting the entry of animals and increasing the possibilities of theft of household production	- To implement a project to build walls and a campaign to raise awareness in the neighbourhood
- Insufficient technical assistance, mainly for fish farming, management of medicinal crops and new agricultural technologies	- For Banco Palmas to seek a partnership with the Federal University of Ceará and the Municipal Prefecture in order to retain specialised technicians
- Limited credit portfolio of bank, making it difficult to meet the demand of loans	- For the bank to seek a partnership with other institutions working in urban agriculture, with the goal of increasing its portfolio
- Difficulties in following-up the project, due to the distance between properties and because the bank team is quite small	- To select the nearest properties and to hire a social services intern to carry out the specific follow-up of the project
- Scarcity and costliness of organic manure	- For the bank to prepare a project for the construction of a composting facility, using the organic waste generated in the community; this facility can then distribute compost to all project members at a much cheaper cost

In order to overcome the lack of experience of some participants, a seminar was organised in the neighbourhood on the following subject: *War against Hunger: A Meeting on Food Security - "Reflections on Urban Agriculture as a local response".* The seminar was a success and created self-confidence in the entire bank team.

However, a major difficulty concerns the lack of available spaces in the neighbourhood for crops and livestock. Because of the rural exodus and the growth of families, all spaces originally designated to the building of football fields, parks and other public spaces were taken up by the settlers' houses and shacks.

The families then decided to initiate the project on their own properties, although their yards were very small (30m^2 on average) and had been used for other purposes. The backyards became a concrete opportunity, since they together represented a reasonable amount of land, especially if organised as a network. The plan is for each block to grow a specific type of crop, guaranteeing a reasonable scale of production.

Confident with this proposal, Banco Palmas bought a small parcel adjacent to its headquarters, measuring approximately 600m^2, where it established an experimental urban agriculture plot, growing vegetables, legumes and medicinal plants, and raising "Caipira" hens. In the future, the project will also develop fish farming and hydroponics. The experimental plot is managed by two women from the hatchery, assisted by an agricultural technician. The members of the hatchery receive daily training on how to grow crops organically, to respect the environment and take advantage of the organic waste generated in the neighbourhood. A technician in Domestic Economy gives lectures in which the participants reflect on the relationship between people and nature and the wealth it offers. Other lectures deal with the nutritional quality of food, the usefulness of medicinal plants and the need to change the eating habits of the community in order to improve the population's health pattern.

Banco Palmas opened a small line of credit for urban agriculture. Each woman wishing to be admitted in the project can ask for up to R $150.00 (about US $40); they then have two months' grace and 15 months to reimburse the loan. The following steps must be followed in order to have access to the loan: submit a credit application; choose the agricultural practice to be developed (cultivation of crop or raising of "Caipira" hens); receive a visit from the agricultural technician to the property for a technical analysis; follow specific training of no less than eight hours on the chosen activity; and receive the final delivery of credit. All of these steps are not slowed down by any bureaucratic red tape. A family can begin the project two days after applying for the loan. Priority for the delivery of loans is given to women members of the hatchery, but the scheme is open to any woman head of household living in the neighbourhood.

This experiment is at its initial stages. Until now it has been possible to assist five women, but the goal for 2002 is to reach one hundred beneficiary families. For this, it is necessary to overcome certain obstacles, as outlined in table 1.

A member of the cooperative assists in the construction of the research station

João Joaquim de Melo Neto Segundo

Sabine Gerstl

Drawing water out of a well, Tanghin, Ouagadougou

Urban agriculture can provide benefits but also risks for urban inhabitants. This study confirmed that the strengths overshadow the risks of practicing home gardening in a sub-Sahelian setting, and underlined the positive economic impact and food security for home gardeners. However, these two benefits depend on seasonal variations and external factors.

Economic Impact of Urban Agriculture

on home gardeners in Ouagadougou

In Burkina Faso, urban agriculture has an important position among the different income-generating activities. According to governmental statistical data, 44%

Income is subject to seasonal variations

of the urban population is engaged in agriculture, which includes home gardening (see box), animal breeding, fishing and forestry (INSD 1994). The selection of vegetables on the home gardening plots depends on local water supply, soil conditions, plot size, use of products and home gardeners' control over future use of the plots. Urban agriculture is a legal part of the urban economy, but is in actuality merely tolerated. In Burkina Faso's capital city, Ouagadougou, the government does not officially permit urban agriculture either in the dry or rainy season. In addition, cultivation is specifically prohibited during the rainy season, especially of tall-growing crops like millet and maize (Quon 1999). Recent data indicated that there are 48 different sites in Ouagadougou where home gardening was being carried out for profit-making (Cissé 1997).

In the study described here, interviews were held with approximately 100 home gardeners (HGs, see box) from three different sites. The total number of HGs at the three sites was difficult to estimate due to the enormous variations between seasons. During and shortly after the rainy season, the fields for home gardening are partially inundated and the gardeners could not fully work there. During this time, they often cultivate their own cereals in the rural villages from which they originally came, or have further activities, such as being night guards or animal breeders. However, our HG sample size represented between 40 and 67 percent of the population of home gardeners.

The three sites Boulmiougou, Tanghin and Kossodo are among the largest in town and can be clearly distinguished in terms of their location in town, social organisation, the pattern of vegetable production and the planting and irrigation strategies (Ndero 1996, Cissé 1997, Desconnets 1998, and Traoré 1999). All of the sites are situated on the outskirts of the town (see map 1 and photos 1 to 3 for a

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Home Gardening is that part of the urban agriculture system which refers to small-scale production of vegetables, fruit, flowers and trees in small plots. In this document, the Home Gardeners are those people whose first and main activity is home gardening, referred to as **HG**s. While **NHG**s refers to Non-Home Gardeners, defined here as the people engaged in activities other than home gardening, but live in the neighbourhood of the HGs (i.e. traders, tailors, plumbers, animal breeders, etc.).

comparative view of the three sites). The interviews were carried out in April 1998 and in October 1999 in order to include both the dry and the rainy season. In order to achieve reliable results, the data of the HGs were compared to a corresponding group of people with activities other than home gardening, (i.e. tailors, mechanics, plumbers or traders). In addition, these "non-home gardeners" (NHGs, see box) lived in the neighbourhood of the home gardeners.

Information was collected on the economic status of HG households and compared with that of NHG households in the same area through a questionnaire. The focus was on income, expenditure and socio-economic status of the households. Monthly income was assessed by asking the interviewees about their income from main and side activities, both in the rainy and in the dry seasons ("directly estimated average monthly income"), and in addition (for the HGs) by looking at the prices obtained for their products ("indirectly estimated average monthly income"). Monthly expenditure was assessed by asking both groups about money spent on food, drinking water and fuel for cooking and energy. All numbers are expressed in the local currency which is the CFAF (*Franc Communauté Financière Africaine*). In October 1999, the exchange rate was CFAF 600 = US $1.

AN INCOME GENERATING ACTIVITY

All of the home gardeners interviewed sold the majority of their vegetables and did not use them for their own consumption only. However, their average monthly income was lower than in NHG households in all three sites and during the dry and rainy seasons. On average, only nine percent of the NHG households earned less than CFAF 14,100 in the rainy season, while the indirectly estimated average monthly income of all HG households was CFAF 8,300, which was still higher than their directly estimated average monthly income. The directly estimated average monthly income of NHG households was CFAF 37,500.

However, home gardening in Ouagadougou provides a cash income generating activity, especially valuable for people with little formal education – home gardeners had an illiteracy rate of 76%, which was significantly higher than that of the NHG group (at 50%) - and mainly agricultural skills.

Two home gardeners explained their situation as follows:

"Our total income comes from home gardening. Because we do nothing other than this activity, our daily living depends exclusively from home gardening. Exclusively means: new clothes, food, free time, health..."

(male, aged 23)

"With the money obtained by home gardening I'm able to look after my amily. ... [ ]...It's this money that helps me to pay the expenditures of food, health and clothes."

(female, aged 34)

ECONOMIC IMPACT OF URBAN AGRICULTURE VARIES ACCORDING TO LOCATION AND SEASON [1]

Home gardener income was not only low but it also differed between the three HG sites examined. The sites with better water quality for irrigation, and a vegetable pattern focusing on European vegetables[2] generated a higher income than the sites with lower water quality and mainly a traditional vegetable[3] pattern. In Ouagadougou, the purchase price of European vegetables was five times high-

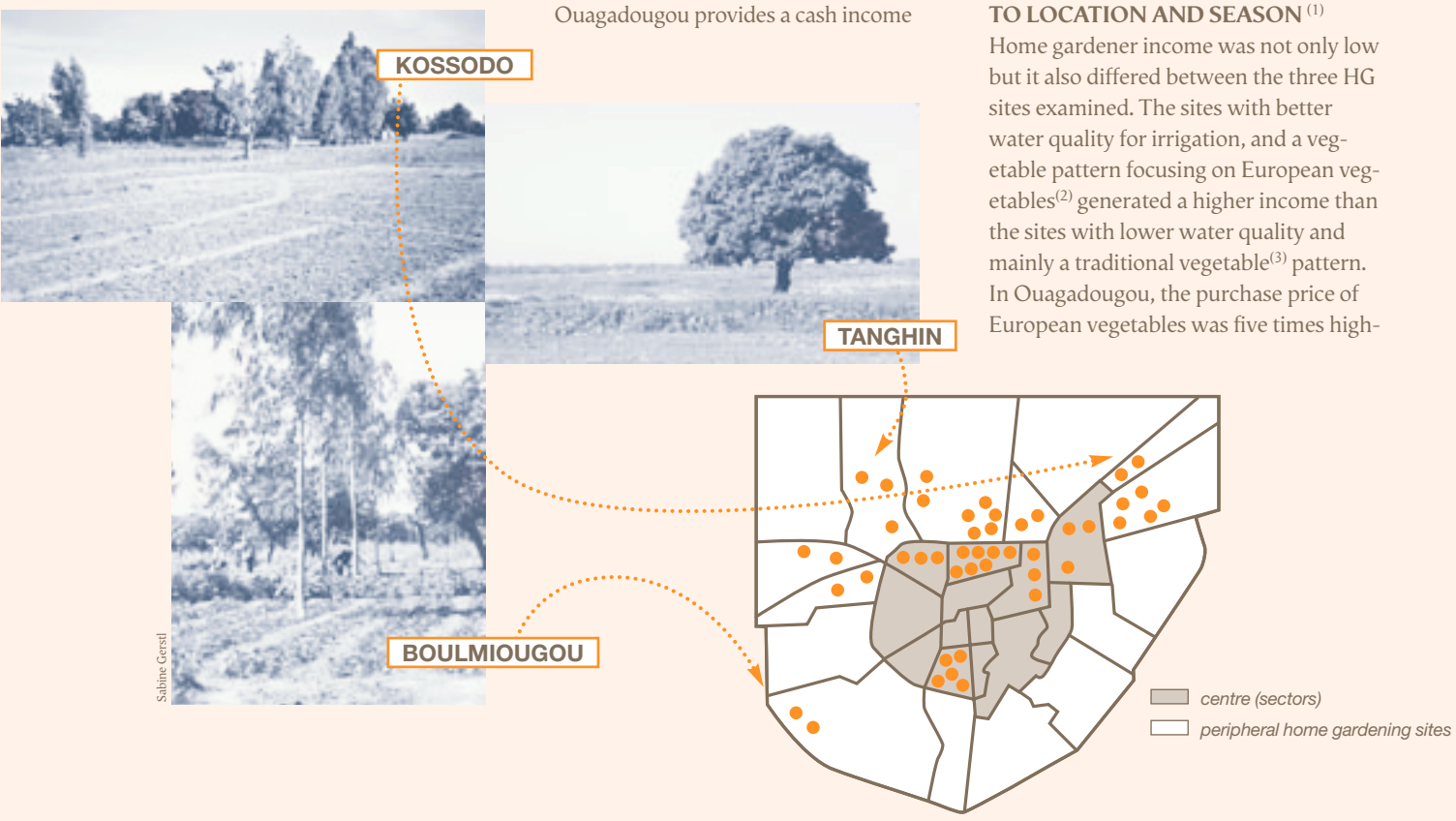

Figure 1: Ouagadougou with its administrative urban units and the home gardens (dots)

home gardening reduced vulnerability to food crises

er than the purchase price of traditional vegetables (Adama *et al.* 1997). According to Djimasbe (1995/96) the HGs charge the same prices in all home gardening sites in town.

In addition, the income was also subjected to seasonal variations. During and shortly after the rainy season (mainly between July and the end of September) the fields were often inundated by water, preventing sowing and weeding. One woman in Tanghin showed this clearly:

> *"Home gardening helps us somewhat, but with the variable rainfall it is not very profitable. There are three months in which we cannot work* [as there is no water to irrigate the fields]. *And here where we are sowing, we could very well suffer a flood at the end of the rainy season."*

The cold, dry season (mainly between December and February) is the peak work season. At that time, the fields are not inundated anymore and there is still sufficient water for irrigation available. All HGs earned on average more money in the dry season than in the rainy season. It varied significantly in Boulmiougou, between CFAF 20,000 in the dry season and CFAF 9,600 in the rainy season ($p<0.001$), and in Kossodo between CFAF 8,300 to CFAF 3,000 ($p<0.001$). Only in Tanghin was the directly estimated average monthly income, at 10.800 CFAF, equivalent in both seasons. As soon as water to irrigate the fields runs dry, which happens normally at the end of the cold, dry season in April, home gardeners had to stop their activities. This is vividly described by one gardener (aged 36, female) in Tanghin:

> *"We start with this* [further activity other than home gardening] *when the water runs out and we have to stop irrigating the fields. We do these activities until we can resume home gardening again."*

A projection of HG income based on the amounts of solely the dry or solely the rainy season would not reflect the real income situation, since their household's economic situation was not stable throughout the year. It therefore depends on the different seasonal conditions, which can mainly be brought down to availability of water. Home gardener households could not count on a predictable economic situation over a long period of time. This made it very difficult for them to maintain a secure economic situation in their households, as there were no opportunities to save money for unpredictable future costs. In contrast, the NHG households had a predictable and stable economic situation at home, as neither their activities nor the related incomes were subject to seasonal variations.

This was also confirmed regarding further activities in both household groups. Only few non-home gardeners had a second activity both in the rainy and in the dry season. However, in the rainy season almost all home gardeners had a second activity, which was mostly cultivation. Up to 23% had a third activity as well. During the dry season, the HGs spent most of their working hours on their fields. To raise the monthly household income, only up to one third practised second activities, which could be carried out outside of the working hours of home gardening (e.g. as a night guard or animal breeder). None of the gardeners had a third activity.

Sabine Gerstl

Focus group discussion held with market vendors at a daily roadside market in Ouagadougou, 1999

FOOD SECURITY IN HOME GARDEN HOUSEHOLDS

Both HG and NHG households spent 73% in the dry season and 69% in the rainy season of their household expenditures on food. This importance was confirmed by a home gardener (male, aged 37), who stated:

> *"Our greatest expense is buying food. For the treatment of illnesses, you also need to spend a lot – but that is not on a daily basis, whereas you are hungry every day."*

In the rainy season, HG households spent CFAF 9,700, a significantly lower expenditure on food than in the dry season (at CFAF 21,000). In this season, the monthly expenditures for food differed significantly between HG and NHG households (CFAF 17,500). However, in the dry season, HG (at CFAF 21,000) and NHG (at CFAF 21,400) households spent more or less the same amount per month on food. The cultivation cycle of vegetables and cereals in sub-Sahelian countries explains seasonal variations in food expenditures in home gardening households. On average, the water runs dry at the end of April. Then in the hot, dry season between April and June, the (subsistence) production of vegetables is interrupted. HG households then run out of stored food and have to purchase food every day at a time when market prices are at their highest point. As not only subsistence production but also the whole local production of vegetables in both rural and urban areas come to a complete halt at this time, vegetables must be imported. According to the average price estimation of 100 different households in Ouagadougou (2000), European vegetables cost up to four times more in the dry season than in the rainy season and traditional vegetables are also priced slightly higher on local markets.

Home gardening reduced vulnerability [4] to food crises in home gardener households, but this has only been confirmed for the rainy season in Ouagadougou. However, as HG households in Ouagadougou belonged to the lower socio-economic classes with little formal education, urban agriculture assists them to improve the quantity, quality and type

Sabine Gerstl

Micro-credit project: food stand in Kossodo, 1999

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of food, at least for half of the year, without spending too much money (Gerstl 2001). Two women, working on the home gardening fields of Ouagadougou, explained:

> *"Home garden products allow us to prepare our daily food."*
>
> *"Home gardening helps me to cover some basic needs, and moreover it provides my whole family with vegetables."*

RECOMMENDATIONS

This study has confirmed the economic and nutritional benefits of urban agriculture (see for example Smit 1996, Brown & Jameton 2000). The strengths of urban agriculture overshadow the risks of seasonality of home gardening in Ouagadougou.

Already today, urban agriculture provides an opportunity for many city dwellers, especially in low advantaged segments, to earn some money and to obtain food for their families through subsistence production. However, families who depend entirely on home gardening for their livelihood have a precarious existence.

Micro-level

It seems appropriate to establish local micro-credit systems in order to improve the economic situation of HG households. In home gardening sites where external factors are acceptable and where the production of vegetables has the potential to lead to economic growth for the households and people involved, micro-credits should be extended to strengthen HG *activities relating to urban agriculture*. The aim of the micro-credits should be to increase the annual income of home gardeners *by increasing the productivity* of the sites. Seeding more profitable European vegetables, cultivating short-cycle vegetables [5] and investing in the equipment for home gardening appear most feasible.

For sites where the external conditions are unfavourable and where urban agriculture is used more for subsistence production rather than for income generation, micro-credits should be used to help gardeners *start a new activity*, which brings more profits the whole year through. Income becomes relatively higher for activities other than home gardening, when the gardening is practised on sites with unfavourable external conditions. Initial successes with micro-projects have already been seen in Ouagadougou. HG women used micro-credits to establish second and alternative income-generating activities to home gardening, such as a food stand, animal breeding or making "tresses" (hair extensions?) for hairdressers.

Macro-level

Urban agriculture has come to be *recognised* as an *important survival strategy for the poor* and should, therefore, be regarded as an important economic activity in an urban setting by government. This could be obtained by organising 'information-education-communication' campaigns (i.e.,Chambers & Guijt 2000), which will bring together decision-makers, representatives of the town and municipality, and the gardeners themselves.

Notes

1) *Seasonality* is the seasonal dimension of poverty, such as adverse factors which may coincide with the rainy or dry season including shortage of food, scarcity of money, difficult conditions for agricultural work, and scarcity of water.
2) *European Vegetables* are those crops of which the seeds and cuttings were first brought to Africa at the end of the last century by the European colonial powers and the Western missionaries; e.g. aubergines, tomatoes, courgettes, carrots and lettuce).
3) *Traditional Vegetables* are local vegetables which were planted originally in sub-Saharan Africa and have already existed there for centuries; i.e., *oseille, boulmboula, boulvanka, gombo*.
4) *Vulnerability* is defined here as the defenselessness and exposure to external risks and lack of means (capacity) to cope (potential) with damaging losses.
5) *Short-Cycle Vegetables* (e.g. cauliflower, beans, salads) have a growth cycle of less than 110 days. Three to five harvests during the home gardening season are possible. *Long-Cycle Vegetables* (e.g. aubergines, carrots and tomatoes) need more than 110 days for growth. One to two harvests during the home gardening season are possible.

Economic Impact of agro biodiversity in the chinampa sub urban system

Ramon Soriano

Characteristic view of a series of chinampa plots

A study was carried out in order to assess the economic performance of the periurban agro-ecosystem known as "chinampa". Chinampa is a small piece of land of irregular form, of pre-Hispanic origin, where habitants from the valley of Mexico still produced a diversity of plants for the city. These were built in a lacustrine setting by reclaiming land bordering a lake and building the plots and a network of channels.

The Chinampa agroecosystem has been characterised as diverse (Jiménez *et al.*1990) and in which a high percentage of seeds are locally produced (Soriano 1998). Losada *et al.* (1998) described the chinampa as a sub-urban production system due to its geographical position within Mexico City. The objective of this work was to evaluate the economic impact on the economy of the *chinamperos* (a Chinampero is a chinampa cultivator) due to the utilisation of local agrodiversity.

THE SURVEY

The survey was aimed at characterising social, economic, and environmental features of production, and was applied to 150 chinamperos. Furthermore, field visits along with structured and informal interviews were applied to a sample of four chinamperos during a twelve-week period, in order to know their main economic inputs and outputs. Two of them were from the San Gregorio Atlapulco village and two from Xochimilco, both within the Xochimilco Delegation of the Federal District, also known as Mexico City. Quantities were adjusted to a hectare to have a comparison basis. Although data were collected from January to March of 1996, no big changes have occurred in the chinampa since then. Monetary values where expressed in US dollars.

THE BIODIVERSITY OF THE CHINAMPA SYSTEM

The chinampa has been characterised as a model that incorporates modern and traditional technologies (Soriano 1998). A high proportion of the interviewed chinamperos (76.5%) used germplasm selected from their own parcels whilst the rest bought improved seed. Also, a high proportion of the cultivators exchanged their local seeds by labour, other seeds and several types of inputs with other chinamperos. The traditional handling of seeds also included a diversity of selection criteria based on the qualitative appreciation of the chinamperos. These can be summarised within four main categories: 1) beauty of the seed; 2) the best seed; 3) the biggest seed; and 4) seed from strong plants. The chinampa area is very well-known for the presence of a diversity of non-domesticated plants that are used for food, green fertilisers, animal feed, and for medicinal and culinary purposes. The four chinamperos who were formed our case studies cultivated a total of 43 different species that included vegetables, maize, legumes, flowers, ornamental, medicinal and culinary plants. This included four examples of plants, which were representative of the genetic and economic potential still unveiled in the area.

The first one constitutes it the edible "*verdolaga*" (Portulaca oleracea), which until few years ago was considered only an eatable weed. Today it is broadly cultivated in greenhouses at San Gregorio Atlapulco. Second example was the culinary "*epazote*" (Chenopodium ambrosioides L.) It is cultivated in small commercial scale in the chinampas area. A third interesting example was the "romerito" (Suaeda torreyana). This plant is broadly consumed during Christmas and Easter thus being a crop linked to local culture. For its cultivation, the seed is gathered in the marshy areas of the chinampas, from wild plants.

Market opportunities create conditions for new commercial crops

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Table 1. Quotient gross margin per hectare/variable costs in the four studied chinampas.

Chinampas	Net margin/ha	Gross margin /ha.	Variable costs	Quotient
1	6303.45	6789.0	485.55	1.39
2	4074.77	4086.5	11.73	34.84
3	3681.93	3900	218.07	1.79
4	6897.30	7000.0	102.7	6.82

This cycle of gathering-sown-harvest is repeated year after year. The fourth example is represented by the plant as known cow´s tongue (Rumex spp) that is used as eatable for humans and as forage for cattle.

THE CASE STUDIES

Chinampa number 1 is owned by Francisco Rosales, a 58 year-old man with three years of primary school studies. He is borrowing (inherited?) his chinampa from his father and has cultivated the land most of his life. At present, Mr Rosales is obtaining all of his income from this plot of 4,158 m^2. He dedicates an average of eight hours per day to agriculture and his wife sells all the produce in the local market place of Xochimilco. Mr Rosales employs chemical fertilisers and on rare occasions, some pesticides. His main crops are spinach and celery and for part of the year he cultivates maize and verdolaga (*Portulaca oleracea*).

Mr Hilarion, the owner of Chinampa number 2 has his plot in the *barrio* of San Marcos, Xochimilco. At present, he works part-time for the government in the *Federal District Rural Development Coordinating Commission* (COCODER). His job is connected with the chinampas of Xochimilco and consists of supporting the COCODER reforestation schemes. These aim to replant the willow species, *Salix bomplandiana,* for anchoring the chinampa plots to the bottom of the channels.

Chinampa number 3 belongs to the Saavedra family, who works a plot of 1,500 m^2, cultivating verdolaga and spinach. Most of their inputs come from external sources. Nevertheless, land preparation is still carried out by hand, using a hoe. They employ improved seeds for both of their crops, as well as pesticides and chemical fertilisers. For verdolaga, they use polytunnels so that they can produce it in winter and, in general, in the dry season. Verdolaga has increased in commercial importance recently, having been used as an edible weed for many years.

Miguel Flores is a retired primary school teacher who owns and cultivates Chinampa number 4. Following his retirement five years ago, at the age of fifty, he decided to take up chinampa production, which he had learnt as a child from his father, who was a chinampero. Mr Flores hoped as a chinampero to keep himself busy, grow part of his family's food in a healthy way and raise some money. He also has some pigs and a cow in his backyard and owns four small plots of different sizes. Miguel Flores grows a variety of different crops. At the time of this study, his crops included beetroot (*Beta vulgaris var crassa*), romerito *(Suaeda torreyana Watts.*), sweet pea flowers (*Lathyrus odoratus*), verdolaga (*Portulaca oleracea*), lettuce (*Lactuca sativa*) and squash (*Cucurbita pepo* L.). Crops in other seasons of the year included parsley (*Petroselinim crispum* Hoffm.), celery (*Apium graveolens* L.) and broccoli (*Brasica oleracea* var. *auliflora*). Pest control is done manually; when a pest is detected, Mr Flores and his two sons squeeze the eggs or the insects by hand.

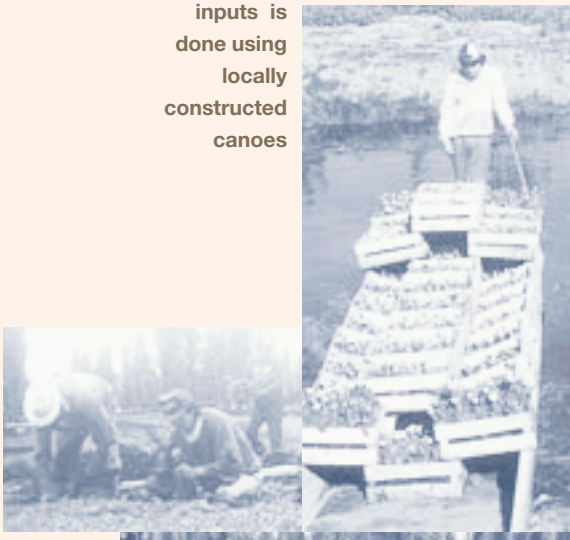
ECONOMIC IMPACT

All of the chinamperos used external inputs although in differing quantity. This influenced the variable costs, which were lower in chinampas 2 and 4 and higher for the parcels 1 and 3. The net margins per hectare were lower in chinampas 2 and 3.

Although chinampero number 2 used a minimum amount of external inputs, he obtained results similar to that of producer number 3. A similar situation could be observed in the chinampas number 1 and 4. The net margins obtained by these were similar although the variable costs were almost five times bigger in the case of Chinampa number 1.

Variable costs were largely influenced by the use of improved seeds, which represented 76.2% of the variable costs in the case of chinampa number 3 and 39.5% for plot 1. Regarding the remaining two plots, the cost of seeds was null since they produced their own.

Transport of produce and inputs is done using locally constructed canoes



Ramon Soriano

The human workforce is of great importance in the chinampa system

Main social features of the chinampa producers

Chinampa plot owners have public services available (100% electricity, 89.1% drainage and 74.8% paved roads). Average family size is 5.9±2.41 members and their main occupation is agriculture 56.5%) and 82.3% of land is private property. Mean size of plots is 2,206.39 m^2 and the years of formal education reach 5.5 per member of the family. Chinamperos hire 0.64 workers per hectare and employ 2.1 members of the family, whilst 58.7% of the total family income is obtained from the plots. Chinamperos sell their produce in the local market place (62.6% of producers) 9.5 % in the central food depot o f Mexico City and 13.6% to the middleman. Production is based on the use of chemical fertiliser by 30% of the interviewed whilst 70% used organic sources of plant nutrients.

The authors wish to thank the chinamperos of Xochimilco and San Gregorio Atlapulco for their collaboration in this work and to the authorities of the UAM Iztapalapa for the facilities provided.

Mixing traditional with modern technologies: use of polytunnels in the chinampa system

Ramon Soriano

The environmental and social benefits **compensate** for the differences in productivity

Another form of comparing the effects of low input use was obtaining the quotient of the gross margin for hectare among the variable costs. Table 1 shows this analysis.

As can be observed, the chinampas that used fewer external inputs showed a more favourable quotient. This means that for each invested dollar, the chinampas number two and four obtained 34.8 and 6.8 dollars return respectively. In addition, chinampas one and two obtained similar and comparatively lower returns in relation to the other two examples.

DISCUSSION

The results show the positive effect on returns when local germplasm is used in the chinampas. Other aspects are also worth a discussion, since traditional practices were, according to the results presented, directly related to a positive impact on the economies of the *chinamperos.*

For years, produce from the chinampas was used for personal consumption. However, market opportunities and facilities from the city created the conditions for the rise of new commercial crops.

Increased biodiversity contributes to the stability of agroecosystems (Altieri 1995). In this sense, the stability of an agricultural system is a factor that contributes to its sustainability. Bellon (1995) proposed an evaluation of agrodiversity based on the management of resources rather than using a reductionist method. This research validates such an approach and goes even further to link economic, social and environmental indicators; suitable as evidenced by this paper.

Another aspect to discuss is the method to analyse the economic performance of an agroecosystem. Analysing economic returns for the chinampa agroecosystem by means of gross margins proved to be a useful tool.

It has been stated that some forms of urban agriculture do not necessarily respond to market schemes. This begs the question: what government policies would be necessary to encourage small-scale production systems that use few inputs, and to strengthen their competitive edge against the highly industrialised and unsustainable production systems? Although the earnings of the four chinampa producers where different, the lowest ones fell below minimum wage and cost of living in Mexico. Besides this, all of the cases had other employment in the city that allowed them to supplement their household incomes in order to achieve a standard quality of life.

Another indicator of resource management and sustainability is the exchange of seeds with other chinamperos. Genetic material was often replaced by other types of seeds, work force, manure or other inputs. This aspect relates to the socio-economic sustainability of the Chinampa, allowing the reduction of production costs while also keeping the social cohesion mechanisms active. While the improved seeds are rarely exchanged due to their high price, the local seeds were exchanged with great ease. In a situation of constant economic crisis, Mexican farmers frequently appeal to strategies to diminish costs of production, such as reducing the use of imported inputs like improved seeds and chemical fertilisers. Such a strategy is very important for the economy of the chinamperos since they are not eligible for credits or subsidies because many do not possess property titles for their chinampas. A last aspect to highlight is that although the productivity of the chinampas with lower variable costs was smaller, the environmental and social benefits might compensate for the differences in productivity. One example of this compensation is that the chinamperos historically have been able to achieve their social reproduction through cultivating the earth in a semi-traditional way.

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Caleb Mireri

Pig shed at an urban farm in Nairobi

Urban agriculture is an important economic activity both for poor and commercial urban farmers. Urban agriculture constitutes an important food security strategy for poor urban farming families. Commercial urban agriculture makes a significant contribution to employment and income generation. The role of urban agriculture has become even more critical in Kenya because of the deteriorating urban poverty situation. Kenyan urban poverty is estimated at 50 per cent and it is feared that the situation will deteriorate in the future (Republic of Kenya 2002).

Private Investment

in Urban Agriculture in Nairobi, Kenya

This paper is based on two key case studies: Kenchic Ltd and Farmer's Choice Ltd. These two private companies are important players in the Kenyan poultry and pig industries, respectively. They support successful agriculture in Nairobi city. Discussions were held with Dr Yamo (Kenchic veterinarian) and Mr Kairu (Farmer's Choice pig procurement manager).

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Lack of credit is one of the major problems facing the development of urban agriculture in Nairobi, the capital of Kenya. National planning regulations exclude urban agriculture from the formal urban land-use system. Most urban farmers practise on public land (road reserves and river banks) with insecure landholdings. The promotion of credit and investment in urban agriculture will require initiatives specific to the sector.

THE NATURE OF CREDIT AND INVESTMENT SCHEMES

Kenchic Ltd and Farmer's Choice Ltd are two agro-industries that support the development of commercial urban agriculture in Nairobi. They offer material and technical support services to both contract and non-contract farmers. Contract farmers enjoy much greater support, but the non-contract farmers receive enough support to guarantee them success. The companies restrict the number of contract farmers to their production capacity and market requirement. The government has been ineffective in the support of urban agriculture. For example, there is no functioning government's poultry and pig farming extension services in Nairobi.

Kenchic Ltd has 60 contract farmers and supports numerous independent farmers (1,250) within Nairobi. The independent farmers raise between 50 and 25,000 chicks per farm. To qualify for contract farming, the applicant must meet the following requirements: have adequate space for 3,000 chicks; meet the cost of labour, water and electricity; have adequate feeders and drinkers; and raise a minimum deposit of US$ 0.8 per chick. In return, Kenchic offers them a guaranteed market; supply of quality feed and chicks on credit; and free active technical support to farmers. Kenchic also supplies chicks to non-contract farmers and lends some support. This arrangement ensures effective participation of farmers.

The credit and investment scheme in the pig industry is similar to that of poultry farming. Farmer's Choice Ltd is a leading agro-based enterprise in pig farming, processing and marketing. It has 40 contract farmers in Nairobi city and a further 200 farmers within the hinterland of the city. Farmer's Choice offers the following support services to contract farmers: guaranteed market; free technical advice; supply of quality breeding stock and feed at the market rate; collection of mature pigs from the farms; and offers farmers recommendation letters in support of financial credit applications. Farmer's Choice often indicates that a guaranteed market is a strong case for creditworthiness. Contract farmers must raise the required capital to purchase the breeding sows; build a shed; meet the cost of clinical services and supplied feed.

Lack of credit is one of the major problems

Material support constitutes a significant aspect of the cost of farm production. The material support can be received on credit

(poultry contract farmers) or at market rates (pig farmers). The material support offered to the farmers consists of feed, vaccines, chicks (poultry farms) and breeding sows (pig farms). The materials supplied by agro-based industries conform to the required quality standards that enhance farmers' returns on investment. Contract farmers have better material support than the independent farmers. The poultry contract farmers receive chicks and feed on credit. The support of farmers is part of the business initiatives of the two agro-based industries. This enables farmers to conform to the best production standards that guarantee quality final products. Dr. Yamo noted that the success of poultry farmers is an important means of expanding the market for the chicks. Apart from chicken production, production of chicks is one of the core businesses of Kenchic Ltd. It supplies chicks to both contract and non contract farmers.

Urban farmers, like any other enterprise, can source investment capital from the credit market. Farmers can seek credit from conventional financial institutions such as Barclays Bank, Kenya Commercial Bank and National Bank of Kenya. This favours middle- and high-income farmers who can raise initial capital from their own savings or have the required collateral security to obtain credit from the financial institutions. Since there are no special credit schemes for urban farmers, commercial urban farmers can seek credit from the commercial and agro-based financial institutions. The high cost of borrowing and the stringent collateral requirements of the financial institutions make credit access a major problem in the promotion of urban agriculture.

Contract farming has inherent weaknessess

THE ECONOMIC IMPACT OF THE CREDIT AND INVESTMENT SCHEMES

The technical and material support offered by the agro-based industries enables contract farmers to undertake successful urban agriculture. However, the agro-industries supporting urban agriculture cannot cope with the enormous popular demand for contract farming – long waiting lists exist that far outstrip the capacity of the existing agro-industrial private enterprises. These industries restrict contract farming to their production capacity and the prevailing market situation. As urban agriculture is not officially recognised in the Kenyan urban development policy, critical support services are lacking in the city. In addition, the existing credit and investment support services mostly favour farmers with initial capital, adequate and secure landholding. Such farmers can source the critical technical services, quality feed and other inputs needed, and can adopt efficient farm management systems.

Nevertheless, contract farming has inherent weaknesses that put the farmer at a greater risk than agro-based enterprise when farming or marketing problems occur. If there is a major decline in the demand for the final product, the enterprise will most likely reduce the rate of production causing financial loss to the farmer.

Non-contract urban farmers are furthermore at a disadvantage in several ways. They have no access to the necessary technical services. It is not possible, for example, for Kenchic to visit the independent poultry farmers regularly because they are too many. However, the company does normally deal with problems reported by farmers within 24 hours. Apart from technical support problems, the farmers must contend with marketing problems. Independent (small) farmers cannot individually effectively undertake the critical aspect of marketing, particularly when a "ready" market is non-existent. This problem could be overcome if farmers were to organise a marketing cooperative society.

Our case study survey reveals that commercial urban agriculture plays an important role in the urban economy. It is an important source of income and employment. The resource persons state that urban farming is a profitable venture and guarantees a quick return on capital. The investment capital is comparatively low for both pig and poultry farming and one can get a good return within a period of two to three years.

Each pig that matures after 6 months earns a net profit of US $27 (US $1 = Kenya shilling 75). A chick matures within six weeks and each chick earns a net profit in the range of US $0.2 and 0.6, depending on the management system. Therefore a contracted poultry farm can earn a net profit of about US $1333 with-

Approximate initial capital requirement to establish viable economic units of urban agriculture, was calculated. The following estimates are based on the current prices and excludes the cost of land.

An economically minimum viable small-scale poultry farm requires 300 chicks either for laying eggs or chicken. Each poultry unit requires a 0.09m^2 space amounting to 27m^2 space for the 300 chicks. It is estimated that a farmer requires an initial capital of US$ 980 and 1870 for chicken and eggs production respectively. This would cover all the required inputs and operational expenses for a 300 unit poultry farm up to the initial sale. It is much cheaper to undertake chicken production because it requires only 6 weeks for chicks to mature for meat, while chicks require 6 months to start laying eggs. Each mature chicken generates a net profit of about US$ 0.4 amounting to a total profit of about US$ 120 from 300 chicken after every six weeks. This indicates that a poultry farmer (meat) can get a return on his capital within 18 months.

Pig farming requires much higher initial capital outlay than poultry farming. To be able to undertake viable pig farming involving a minimum of 5 breeding mothers, a farmer requires an initial capital of about US$ 2933. This would cover all the required inputs and operational expenses for a five breeding mothers' pig farm up to the initial sale. Five breeding mothers is the minimum viable economic pig farming unit. Each pig requires 30cm-wide feeding space, so a space of about 29.7m^2 can support pig farming. The feeding mothers are expensive (US$ 187), but each mother delivers about 10 piglets 2.5 times a year. A pig matures after 6 months, so within one year a farmer can get 100 mature pigs from 5 breeding mothers. Each pig earns a net profit of US$ 27. Therefore a pig farmer with 5 breading mothers can earn a net profit of US$ 2667 per year. According to this estimate, a pig farmer gets a return on his investment within a period of 18 months.

René van Veenhuizen

Profitable farming can be practised on small parcels of land

Caleb Mireri

Viable pig farming involves a minimum of five breeding sows

in six weeks, which translates into about US $9,333 per year. In addition, urban agriculture is an important source of direct and indirect employment. Apart from family labour, low skilled labourers are employed by the commercial urban agriculture and the agro-based industries that supply it.

Furthermore, profitable farming can be practised on small parcels of land in the urban areas. Although most poor families rarely have sufficient space for profitable farming within their homesteads, a sizeable proportion of middle- and high-income families have adequate land for urban agriculture. Many households in periurban Nairobi have relatively better access to land and could be active participants in commercial agriculture.

POLICY OPTIONS FOR SUSTAINABLE DEVELOPMENT OF COMMERCIAL URBAN AGRICULTURE

The case study results show that commercial urban agriculture is a viable economic activity in the city of Nairobi. It is an important source of income and employment; for example, a contract poultry farming family earns a net profit of about US $1,000 per month. Also, urban agriculture is an important component of food security for poor urban farming families. Urban agriculture includes both crop (horticulture) and livestock (poultry, dairy and pig) production. However, the sector has limited credit and investment opportunities that cannot effectively spur its growth and development. The existing support systems are by far inadequate to meet the enormous demand.

The government has an invaluable role to play in the promotion of urban agriculture. The integration of urban agriculture in the urban land-use system and the creation of a favourable policy environment are critical steps in the development of the sector. Furthermore, there is a need to form farmers' associations and marketing cooperative societies. A strong farmers' association can articulate and lobby for necessary government recognition and general development of the sector. Marketing of cooperative societies can effectively address marketing problems, thus enhance the profitability of urban farming. Also, urban farmers lack critical information on the best farming practices and available support services. Through an appropriate urban farmers' association, avenues can be created to disseminate important information to farmers on the available support services.

The government has an invaluable role to play

Our case study survey showed that urban agriculture can lead to a return on capital within a short period of time (between 2 and 3 years). An effective management of a temporary lease agreement on public and private land can enable urban farmers to undertake investment and earn income from farming. Temporary lease agreement will create some order and security among the most vulnerable (poor) urban farmers. These farmers could then source technical and material support.

Savings and Credit Cooperative Societies can be effective means of mobilising resources for the development of commercial urban agriculture. This can only succeed in an organised urban farming system. The formation of a savings and credit cooperative society is a long-term commitment that would favour long-term urban farmers operating on their own land.

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This question has been answered (on paper) by the Southside Chamber of Commerce in the city of Brisbane, in sub-tropical Australia. The chamber calculated that with a little more than A $200,000, a "rooftop microfarm" based on waste management could yield around 20% return on invested capital, and employ three to four people. The Southside Chamber of Commerce Urban Agriculture Group is now considering how to fund a pilot project in Mt Gravatt Central in Brisbane, in the state of Queensland to prove the feasibility study findings.

Geoff Wilson

Portable organic hydroponic structures for tomatoes

Can Urban **Rooftop Microfarms** be profitable?

The urban rooftop microfarm project proposed at Mt Gravatt is best described as a *nutrient capture system* that offers organic waste recycling as one important community benefit, and reduction of the greenhouse gas, methane, as another. It also provides income and employment

The project in suburban Brisbane's Mt Gravatt Central will further develop and test organic hydroponics and integrate aquaculture with hydroponics ("aquaponics") to offer local restaurants a range of "organic" produce.

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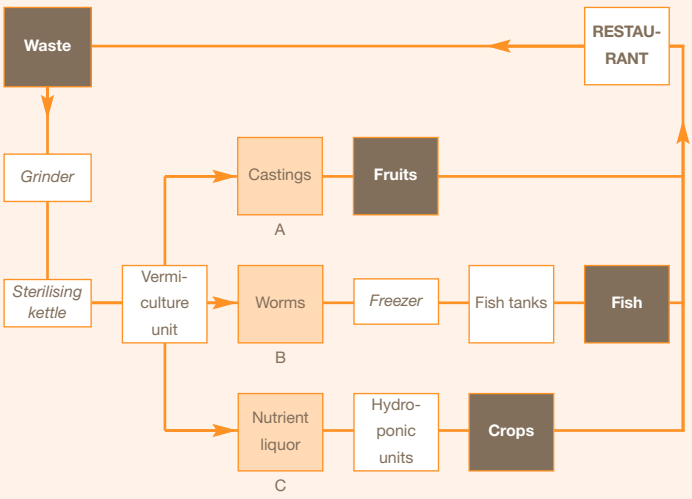

Figure 1: Flow diagram of the proposed urban rooftop microfarm

It will entail the following recycling activities (see Figure 1):

- collecting of food wastes from restaurants within half a kilometre radius of Mt Gravatt Central;
- pulverising and heat-sterilising of these wastes, and perhaps adding supplementary organic material or minerals for nutrient balance;
- feeding of the pulverised food wastes to an innovative worm farm that provides a continuous flow of output rather than a batch process, including: (a) liquid nutrient for organic hydroponics; (b) worm castings for containerised growing of fruits; and (c) surplus worms to be frozen and subsequently fed to fish or crustaceans (crab, lobster);
- production of salad vegetables and herbs from organic hydroponics, fruits in containers; and aquaculture; and
- selling of the produce to the same restaurants.

The Southside Chamber, of which the author is currently President, sought and obtained a A$20,000 grant from the Australian Federal Government of Employment Workplace Relations and Small Business in 1998 for its Urban Microfarm Feasibility Study in Mt Gravatt Central. The commercial microfarm concept was tested in 1999 by Integrated Skills Consulting Pty Ltd, of Brisbane.

THE FEASIBILITY STUDY

The Urban Rooftop Microfarm concept of the Southside Chamber differs from many previous studies in that it involved an urban microfarm with three objectives:

- Production of food in a way that contributes actively to a better environment using minimal space
- Provision of employment opportunities for people disadvantaged in the labour market
- Achievement of sustainability through the profitable sale of produce.

The project studied how a microfarm could be a business serving a market within a small radius of a shopping centre – perhaps only half a kilometre from the microfarm site. This included:

- the collection of waste food from nearby restaurants, hospitals and clubs;
- the use of this waste in the worm farm.
- the microfarm concept situated on rooftops of commercial buildings or at ground level in Mt Gravatt Central, growing salad vegetables and herbs; and

Food wastes that normally go to landfill and then cause methane emissions can be reduced by earthworms to their soluble nutrient form for recycling via horticulture. Methane is some 21 times worse for the environment than carbon dioxide.

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Table 1 Amount of funding required to launch the project successfully

Set up and management facilitation	A $ 30,000
Capital assets purchase/installation	A $ 115,455
Initial working capital	A $ 67,000
TOTAL FUNDS REQUIRED	**A $ 212,455**

1 US $ = 1,85 A $

Table 2: Estimated financial performance for three revenue-earning enterprises over 30 months

	First 6 months	Year 2	Year 3
Hydroponics	A $ 36,360	A $ 108,125	A $ 108,125
Aquaculture	A $ 32,575	A $ 130,300	A $ 130,300
Vermiculture	A $ 5,100	A $ 15,610	A $ 15,610
EST. TOTAL REVENUES	**A $ 74,035**	**A $ 254,035**	**A $ 254,035**
EST. GROSS PROFIT	A $ 47,840	A $ 199,865	A $ 199,865
EST. NET PROFIT	-A $ 32,430	+A $ 34,016	+A $ 35,015

❖ the selling of salad vegetables, herbs and fish back to the same restaurants, hospitals and clubs.

Integrated Skills Consulting concluded that with a total funding of A$212,000, a microfarm on a Mt Gravatt commercial rooftop (or equivalent urban space) could be profitable after 17 months of operation. It could then provide a return of around 20% a year on invested capital. It could provide three to four new jobs for each microfarm, possibly jobs suited to people with a disability.

The consultants said that a capital investment of A $212,455 would ensure that the project would not run short of funds at any stage, but the figure did not give a margin for error.

Cashflow projections were indicative only, because total annual costing was applied evenly on a monthly basis. Nevertheless, the consultants reported that the cash flow showed the expected generation of revenue and expenditure under the economic conditions in Brisbane, Australia in 1999, over the first 30 months, and with progressive repayment of A $32,000 in working capital required to tide the enterprise during the start-up period (see Table 2).

The consultants emphasised that the resultant achievement of 19.4% return on capital invested was conditional on relatively conservative production targets being achieved, and on the following of a recommended marketing plan. Key factors were proximity to markets, consistent supply of high quality fresh produce and stable pricing.

The study set out specifically to:

❖ Identify the project's technical platform components, cost and availability. The three were (a) horticulture which cost about A $50,000 to set up, (b) aquaculture which cost about A $14,000 to set up, and (c) vermiculture which would cost about A $5,000 to set up – the total being around A $70,000 for equipment specific to these enterprises, but not including shared equipment such as a motor vehicle.

❖ Identify job and business opportunities and local target groups for those opportunities. It was estimated that three to four jobs would be created.

❖ Assess any support/concerns from the general and business community. Noise and smell were found to be concerns, but support potential was excellent.

❖ Identify markets, supply sources, product acceptability. Indicated markets within a kilometre were generally most enthusiastic because of the waste management advantage.

❖ Determine commercial viability via a business plan outline. This was proved – at least on paper.

❖ Examine benefits for the built and natural environments and identify issues of concern to authorities.

❖ Provide a skills audit.

❖ Specify potential support for funding.

❖ Review training needs.

❖ Examine effects on current suppliers (e.g. rural farmers).

While there are conventional farms in the periurban areas of Brisbane, these remain under threat from urban expansion, which brings up the environmental concerns about the use of fertiliser and pesticides/fungicides and rising production costs related to land value. The study took the view that an Urban Rooftop Microfarm must avoid such problems by adopting a different approach, using urban spaces not normally considered for farming.

It was clear that the expense of this approach (cost of urban land) could be offset by greatly reduced costs in transport and energy use and by providing high quality produce for a premium price, where it is needed.

Many potential customers interviewed said they were prepared to pay about 10% more for organically grown local produce that was harvested for same day sale. The 10% was elicited as a fair "premium" to pay, and probably was a response based

Portable vertical structures for lettuce and herbs, using oval-pipe organic hydroponic techology

Geoff Wilson

on existing premium expectations reported widely in technical and consumer news media. They were also comfortable with the concept of organic hydroponics via worm liquor developed from restaurant food wastes.

The study identified by-products of vermiculture as being important to the final mix of products to be offered back to restaurants. Worm castings could be used in containerised growing on rooftops, or sold as a valuable soil additive sought by local home gardeners. Also, surplus worms produced would be used as a food source in the secondary food production stage involving holding mature fish or crustaceans in tanks after being bought from rural aquaculture farms.

The proposal required maximum production from a minimal area "footprint". The site size chosen for the study was 600 square metres because such a rooftop size in Mt Gravatt was more readily available than sites of 1000 square metres or more.

Of the various hydroponic systems reviewed in the feasibility study and experience of a number of commercial growers, it was considered that the locally-developed Boxsell "Ell-Grow" system of oval-channels most readily met the needs of this project (in a sub-tropical climate).

The proposed layout for the hydroponics occupied 450 of the 600 square metres, with six rows of eight 3 x 2 metre tables, all covered with hail mesh and insect screening. While the actual growing units formed the core of the system and represented the largest single cost element, other components were needed to complete the whole system. Using commercial worm beds as a basis, a purpose-built system can be configured by stacking a number of them in a robust pallet frame in such a way that they can be rolled out and back for access like a series of filing drawers.

The other equipment was a shredding machine to reduce worm bed material and vegetable matter to a finely ground mulch, a boiler to heat the mulch to remove pathogens, small pumping systems to re-circulate the liquid passing through the worm beds, storage for the worm liquor and a worm/castings separator. An assortment of minor tools and equipment to assist in this process would also be required.

Aquaculture is an established technology and there are many examples of successful fish farms operating in Queensland, which could supply mature fish or crustaceans to be held ready for local restaurants to purchase. The fish species recommended was "Silver Perch" an Australian native freshwater fish, which is ideal for the restaurant and retail markets. The use of aquaculture to grow silver perch thus completes the circle of this proposal. But "Jade Perch" (previously named "Barcoo Grunter") would be an easier option.

The feasibility study concluded that:
"the above systems combine to present a viable means of growing a range of hydroponic vegetables, fruit, fish and worms. The system components are either commercially available, incorporating proven technology, or where they need to be purpose built, they can use proven elements that offer reliable results.(...) It must be recognised that in the use of organic nutrient from vermiculture processes as described, there is a less precise degree of control of nutrient content than would be the case with inorganic fertilisers. This is not considered to be a problem as plants naturally take up what they require for growth from the available medium and the worm liquor analysis shows that such an organic nutrient is rich in what they require. The main difference will be that all of the nutrient available may not be taken up and some will go to waste. (..) On balance The Urban Rooftop Microfarm project appears to positively address all of the issues and should therefore be accordingly judged as a feasible venture,"

Worm liquor is less capable of precise specification than are inorganic chemical solutions, because the nutrient content varies according to the nutrient value derived from different worm food sources – in this case from Chinese, Italian and Australian styles of cooking. However, the nutrient balance of worm liquor can be adjusted by adding rock dust, a natural mineral-rich product, or specific organic materials (such as pineapple tops for extra magnesium). Some additional, simple heat processing would be required to ensure pathogen-free and readily digested waste matter for the worms.

The Southside Chamber's feasibility study also revealed a number of issues requiring resolution in setting up an Urban Rooftop Microfarm. They included:

- zoning issues: in Brisbane and other parts of Australia commercial enterprises are generally banned from residential zones, while in commercial zones there can be problems with perceived noise and smell issues;
- production facility operation issues such as noise; smell; traffic; effluent and waste & exhausted nutrient solution disposal; lighting impact and restrictions; signage and aesthetics;
- space and site management issues;
- health, hygiene and sanitation regulations compliance;
- food waste delivery and storage issues, which focused on the regulations governing the handling, transport and storage of food waste in Australia. These concern both human hygiene and animal protection from exotic diseases, such as Foot and Mouth disease;
- workplace health and safety issues;
- benefits accruing to the built/natural environment; and
- compliance with municipal, state and federal regulations – particularly in food safety for consumers.

The Southside Chamber of Commerce sells copies of its full report of 156 pages for A $35 plus A $15 postage and packing – total of A $50. *A 25-page summary of the report is available for A $5 per view at www.urbanag.info or www.L-COCO.info*

Geoff Wilson

Containerised growing of fruit, using worm castings and cycling worm liquor

Impact of Urban Agriculture

reduced prices in Havana

Urban agriculture emerged in Cuba, and specifically in Havana, from the critical economic crisis of 1989, as a response to food insecurity. Today, it has become one of the largest sources of employment in Havana, improving the supply of fresh produce and ensuring greater stability and availability of, especially, leafy vegetables. Until the emergence of urban agriculture, the agricultural markets (numbering 58 in April 2000) were the only option for unregulated agricultural produce, gradually becoming a reference point for prices in the domestic economy.

The shift from producing primarily for personal consumption and subsistence needs to a market-oriented agricultural sector fostered the amendment of city legislation. This allowed for marketing to happen both at the production sites and at specific locations where groups of horticulturists, cooperatives, and intensive and "organoponic" garden growers came to sell their produce. In the year 2000, more than 550 of these marketing sites were scattered throughout the capital.

Intensive urban production methods and direct marketing have influenced the prices of agricultural products in Havana. Figure 1 illustrates how prices of four products have dropped at the large agricultural markets in the city and elsewhere in Cuba since 1994, at which time the provincial group for urban agriculture was established in Havana. The reasons for this impact are related to the direct communication between producers and consumers, which avoids the involvement of intermediaries and the costs involved; and selling the produce directly where it is grown, which also helps to cut costs and transportation losses.

Although food prices continue to be high for a large majority of residents, and food is still a major concern for the consumers and the authorities, the drop in prices has led to a situation in which more people can afford products that are of better quality.

Figure: Price differentials of four agricultural products between 1994 and 1999

[Source: Charts are based on information provided by the National Statistics Office (2000)]

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Shingi Mushamba

Demonstration plot for Musikavanhu Project in Mabvuku

One principal factor for the slow development of the urban and peri-urban agricultural sector in Zimbabwe is the inadequate, or in some cases total absence of financing arrangements, especially from the formal sector. There are two explanations for this state of affairs, first that the rapid rise in urban agriculture is a fairly new phenomenon, and second, that it has also retained the tag of an illegal activity in most urban settlements. As such, funds that have been available to other sectors from especially non-governmental organisations and international development agencies have not been extended to urban and peri-urban agriculture.

Different Kinds of Investment

Kintyre Lake County and Musikavanhu Project experiences in Urban Agriculture

Zimbabwe has an agro-based economy with a well-developed agriculture sector. This sector is categorised into five levels: large-, medium- and small-scale commercial farming, communal farming and more recently the category of resettled farmers [which can also be categorised into large, medium and small scale]. Urban agriculture can be considered to be a recent addition to these categories, although it is not exactly a new phenomenon. The areas under cultivation have increased by over 100% since independence in 1980. The last increase is attributed to the impact of the economic structural adjustment programme (ESAP) introduced in the early 1990s. Under ESAP, urban agriculture has become an important coping strategy for resource-poor families. The use of the urban space for agricultural purposes in Zimbabwe has been classified as 'on-plot' and 'off-plot' types. The on-plot type is usually practised on the residential stand itself and is usually limited to the production of vegetables. There are three main types of residential plots in urban Zimbabwe, based on size as follows: high density (150 – 300 m^2); medium density (300 – 1,000 m^2), and low density (1000 m^2 and above). The off-plot agricultural activities on the other hand take place on open spaces reserved for future uses, and along riverbanks, dams and catchment areas, along roadsides, railway reserves and hills. These types of activities can either be legal or illegal depending on whether permission from the local authority has been granted or not. Until recently, local authorities have viewed urban agriculture as demanding a large portion of urban land and having negative environmental and health impacts. The authorities therefore tried to deter or stop agricultural activities from continuing, though this attitude has since changed. Now, urban local authorities, with the help of non-governmental organisations like the Municipal Development Programme (MDP) and Fambidzanai Permaculture Centre are seeking ways to work together productively with urban farmers to promote sustainable and environment-friendly urban agriculture.

There is a need for a tier of local institutions to emerge

Commercial farmers practise high value intensive peri-urban agriculture on farms surrounding the city. Peri-urban communal production is also practised in satellite areas to Harare, such as Seke and Domboshawa, from which tomatoes and other vegetables are drawn.

This article draws on the experiences of two schemes in Harare – Musikavanhu Project and the Kintyre Lake Country (KLC) Development. The former is a fairly well established co-operative scheme for the urban resource-poor that has been in existence since 1998 while the latter is a land development scheme implemented by the private sector since 1999. The two provide useful information on which to evaluate the prospects for financing urban and peri-urban agriculture for the different income groups.

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KINTYRE LAKE COUNTY DEVELOPMENT

Kintyre Lake County Development (KLC), formerly Kintyre Estates, is a land development project that integrates urban agriculture and other traditional urban land uses. The project is situated 27 km from central Harare along the Bulawayo road. It is a multi-faceted peri-urban development project valued in excess of Z $2.4 billion[1]. When the project is complete, it will have 50 intensive agricultural plots and 86 mountainside residential units for executive homes, a holiday resort centre comprising an upmarket hotel and casino, a business centre with food courts and retail shops, and an on-site Export Processing Zone, among others.

There is a demand for peri-urban plots by the urban elites and KLC is filling in the gap for this niche market. The purpose of the project is to provide land and other development opportunities to high-income earners. The project was conceived as a direct call by the Government of Zimbabwe to intensify the export drive and facilitate economic empowerment. The plots are on freehold tenure.

Although the project is in its infancy, it has generated substantial interest from local, regional and international investors. Investors regard the project as an opportunity to increase their portfolio.

Several institutional and private sector investors supported the project's infrastructural development. The development of residential and commercial properties will be financed from savings or mortgage financing from building societies. KLC is an economic venture that aims in the first instance at enterprise development in agriculture. The area has 50 plots, with a minimum of 10 hectares, which can be utilised for agricultural purposes. The agricultural component will specialise in intensive horticulture and floriculture, some within greenhouses. Marketing is facilitated by the establishment or conferring of export-processing-zone status, meaning that the small-scale agricultural concerns in the area will be able to enjoy incentives to export their produce. Furthermore, the area has easy access to th main road.

The co-operative has had no major investors

The impact of this project is both at city and regional level. When fully developed, the project shall increase food security for the towns in the vicinity; generate employment; and revenue through taxes.. The agricultural component of the project shall create employment for thousands of Zimbabweans in the production, marketing and manufacturing of agricultural products. The Export Processing Zone will benefit the Zimbabwean economy by increasing foreign currency earnings from the production of flowers of which Zimbabwe is the second largest exporter in Africa after Kenya. The owners of plots shall be the direct beneficiaries as they will earn income realised from the production. The EPZ is set to earn Zimbabwe US$50 million in foreign currency annually from the proceeds of the exports.

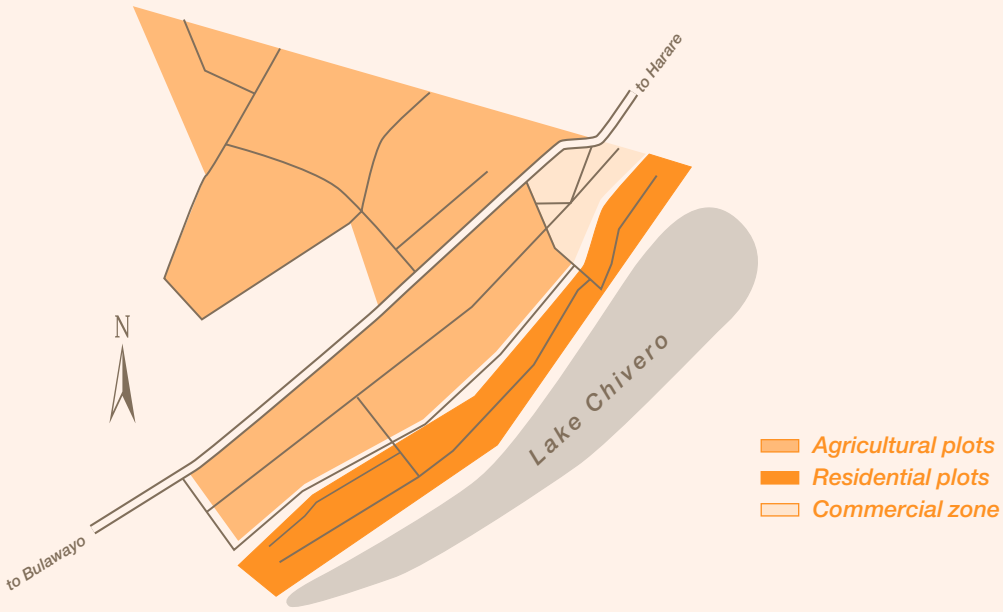

Figure 1: Lay out of Kintyse Lake Country

MUSIKAVANHU PROJECT

Residents from a low-income suburb of Budiriro in Harare initiated the Musikavanhu Project in 1999, with the aim of improving the living standards of the urban resource-poor from urban farming. The project was a direct response to a call by the city authorities for urban farmers to be organised so that the Harare City Council could engage with them on issues of urban farming. Some of the objectives of the project are to lobby for land, mobilise other resources and inputs, and facilitate networking with key stakeholders in order to improve food security and incomes and empowerment of its members.

During its formation, the project engaged in a land and membership mobilisation exercise. By promising urban farmers that were already cultivating in open spaces that they would retain the use of their plots if they joined, and that they would benefit from its wide network of supporters, including the government, it attracted urban farmers in the suburbs targeted to join in. The Project's activities have spread to other low-income suburbs of Harare that include Glen Norah, Tafara, Mabvuku, Mufakose and Kuwadzana. The group has an acclaimed membership of twenty thousand in Harare alone. The project practises both on-plot and off-plot cultivation, and specialises in staple and cash crop production using both mechanical and manual methods. There are also plans to launch the project in other cities in the country.

The project members are organised in groups of thirty families each, called phases. Committees, whose chairpersons are members of the project's overall executive body, run these groups. Free inputs for demonstration purposes are mobilised from well-wishers and provided to all groups. Each group has a demonstration plot, and in total the project has an estimated 10 acres of demonstration plots

around the city. Project members have todate received extension services from the Department of Agriculture's Technical and Extension Services, Seed Company [SEEDCO] and Agricura and Monsanto Zimbabwe

Each household has a plot allocated to it for growing vegetables during the dry season and maize production during the rainy season. During the 2001/2 farming season, members of the co-operative individually benefited from the government-sponsored input credit scheme.

The project has had no major investors. Currently, it draws income from members's subscription fees. Each member pays an initial membership fee of Z$300 [1] and thereafter an annual subscription fee of Z $150. However, most members are not up-to-date with their payments, a result of the economic hardships. Many members stopped paying once they were allocated the plots. Only about 20% of the members pay their subscription fees each year. This has been tolerated because the bulk of the membership is unemployed.

The project was initially dominated by women

The leadership of the project has approached many organisations for financial and material support. The sole agricultural bank in Zimbabwe, Agribank, was approached for financial assistance in March 2001 but has todate not responded. Most sponsors are reluctant to support the project because urban agriculture is still perceived as an illegal practice and not as an alternative form of urban land use. Input suppliers provide assistance as a marketing strategy. Recently, Environment Africa and Nico Orgo, a organic fertiliser manufacturing company have committed themselves to support the project.

The Musikavanhu project covers several thematic areas. These range from poverty alleviation, social services and environmental management. The project was initially dominated by women as men felt that urban agriculture was not a lucrative activity for them. However, with the demonstrated results and the realisation that formal jobs will be difficult to come by, some men have joined the project. However, the effective participation of women is still limited by their other domestic duties. Whilst women form a very large majority of the members of Musikavanhu, the leadership is largely made up of men.

The project has succeeded in demonstrating that it is possible to practise organised and sustainable urban agriculture with the support of the local authority. The project beneficiaries are the urban poor and unemployed. There are approximately 20,000 people who benefit directly as members in the form of income and food supplies. The average size of a family in Zimbabwe is six, which means that there are about 100,000 more people who benefit indirectly from the activities. Family income is increased and the food security situation in the member households is improved.

The impacts of the project are diverse. The objectives of ensuring food security, income, good nutrition and providing employment for the urban poor are slowly but surely being achieved. Urban agriculture stakeholders have been conscientised on the importance of this activity in poverty alleviation. This has seen input supply companies, government, AGRITEX, the Department of Natural Resources, the city council and the police beginning to appreciate that urban agriculture is an alternative way of using idle urban land. Women have also been empowered and can now make decisions on using and contributing to the family income.

The work of Musikavanhu Project was greatly enhanced by the prevailing harsh economic conditions in the country. The high retrenchments meant that most people lost their jobs and had to engage in alternative production systems, especiually in the informal sector. The project offered hope in giving them a chance to produce their own food and so reduce their household budgets on this item and meet other basic needs.

CONCLUSIONS

The indications from the KLC Development case study are that high value, intensive urban agriculture in periurban areas and on large plots will attract sufficient funding for development and growth, especially from the private savings and traditional agribusiness finance institutions. The freehold tenure that it enjoys, or in some cases long lease, the potential for high returns and the long established tradition of financing such projects are fundamental for facilitating availability of financial support services. Investors view the project as low risk and thus are prepared to invest large sums of money. The project even has approval from the government seen by the issuing of an agricultural subdivision permit from the Ministry of Local Government and National Housing.

Unlike KLC, Musikavanhu Project's contribution to the city's local economy is still ignored. The fact that City of Harare has not yet reviewed its by-laws to make urban agriculture a legal urban land use does not provide incentives to, especially institutional actors to invest in it because of the perceived high risk involved. However, the project has managed to attract a large membership and growing support from a some institutions.

Traditionally, household savings have financed on-plot urban agriculture activities in Zimbabwe. On fairly large plots where external resources are required, informal networks have been very useful. In the case of high-density residential suburbs, the availability of on-plot land is very limited, to the extent that no significant investment for on-plot urban agriculture is required. It is on the open spaces that urban agriculture that can benefit the urban poor requires significant investments. The key question that needs an answer is how open space cultivation can be supported and financed in order to benefit the urban poor.

There is a need for a tier of local institutions to emerge and provide support services, including financing mechanisms for open space cultivation in Zimbabwe.

Notes

1) The current official exchange rate for the Zimbabwe dollar against the US dollar is 1:55. However, on the thriving parallel market, the rate is 1:550.

Maximising Private and Social Gains of Wastewater Agriculture in Haroonabad

Wastewater Disposal Station at Chak 73/4-R, Haroonabad

In many countries, using wastewater for irrigation purposes originated as and has remained an unplanned activity, practised for centuries by poor farmers in urban and periurban areas. It has also become a widely accepted, though unregulated, practice in many countries. Due to growing populations, weak financial health of municipalities and weak or non-existing institutional and regulatory mechanisms, it is likely to continue as the main wastewater treatment strategy in the developing world.

The work reported here was part of a larger study that assessed the economic, health and environmental costs and benefits of wastewater irrigation
(Van de Hoek, et al., forthcoming.)

While irrigation with untreated wastewater certainly has health and environmental risks, it may have important economic and environmental benefits for both farmers as well as the society. The societies may benefit from limiting pollution to localised areas, instead of polluting surface waters through untreated wastewater disposal. The farmers themselves conserve nutrients, reducing the need for artificial fertilisers, and increase crop yields. They may also be able to "save" fresh water for other users and uses by meeting their irrigation demands through wastewater irrigation. Farmers may also have more reliable water supply from the wastewater than that supplied through poorly managed canal systems.

This comparative study summarises the private and social costs and benefits of wastewater irrigation vis-à-vis canal irrigation in a small town setting of a water scarce area of Pakistan. The current arrangements for wastewater disposal and use are analysed with a view to identifying an alternative approach to wastewater use planning and disposal which maximises benefits and minimises costs.

SITE CHARACTERISATION AND INSTITUTIONAL SETTING

This study was carried out in Haroonabad town in the southern Punjab province of Pakistan. Haroonabad had a population of 63,000 in 2001. Rainfall is mainly limited to the monsoon periods of July and August and is quite scanty, averaging 160 mm a year. Groundwater is brackish and therefore water supply to the town and crops is dependent on irrigation water from the nearby Hakra-4/R Distributary Canal.

While the main population lives in the central parts of town, recent decades have witnessed new colonies emerging as satellites around the town, each having a separate water disposal unit. Some of these sites have only recently been irrigated with wastewater, while others, including the main site have been practising wastewater irrigation for the past thirty-five years.

The approach to wastewater disposal has not changed over the years, however. The effluent is mainly used to irrigate an area of 120 ha at the main site and an area of 25 ha at the two smaller schemes. The total volume of disposed water approximated over 4,600 m^3 of raw sewage a day at the time of our study.

The municipality is responsible for

Data Collection

Data were collected in 2001 from 20 wastewater farms at the main disposal site of Haroonabad, and 20 canal water farms located within a radius of 5 kilometres from the centre of the town. The data were collected through weekly panel interviews with the respondents, on-site water measurements, and secondary sources like the market committee and key informants. The use of inputs, costs of production and value of production were calculated and compared. The details of the methodology are described elsewhere (Van der Hoek *et al.*, forthcoming). T-statistics were used to compare means wherever possible.

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The surplus of individual farmers was too small to export to large city markets

provision of water and its disposal, whose responsibilities end at the disposal station, at which point the farmers take over the management and use of the wastewater. Only those farmers whose land was located in the vicinity of the disposal stations and were connected to the wastewater disposal channel were able to use it for irrigation purposes. Other farmers had to seek agreements to trespass wastewater-connected lands in order to connect their watercourses to the disposal channel. The permission is not generally granted, however. The farmers using wastewater have evolved mechanisms of cooperating with each other. All farmers have rights to the canal water, but they do not presently use canal water at these sites.

In Haroonabad, the wastewater channel is state property. To connect this channel to other farms is not possible without the consent of all farmers owning lands connected to the channel, which can be obtained through a process of negotiation, dialogue, and other social mobilisation processes. No institutional arrangement for organising farmers for promoting collective action for wastewater irrigation did exist, however [1].

Land ownership is found to be a symbol of prestige in the area. Working with wastewater is seen as an inferior occupation. Therefore, richer landowners do not engage in direct farm operations at the wastewater-irrigated farms, and prefer to lease their land out. The lessees tend to operate larger consolidated holdings by arranging leases with more landowners. Since wastewater farming in the area mainly concerns intensive vegetable cultivation, it requires more labour inputs during land preparation, seed sowing, and harvesting. There is a general tendency among the lessees to share out small parcels of 1-2 ha to the tenants with larger families, who could provide family labour for farm operations. Water rights are automatically transferred with land, but day-to-day distribution of water among various tenants has taken place with mutual cooperation and understanding.

Table 1: Comparison of inputs, costs, and Value of Product on wastewater and canal water irrigated farms

Description of Variable (unit)	Canal Water Irrigated Farms (n=20)	Wastewater Irrigated Farms (n=20)	t-value
Average cost of land preparation (Rs/ha)	2897	4734	4.54[2]
Average cost of Seed (Rs/ha)	2903	5409	3.44[2]
Average cost of chemical fertilizers (Rs/ha)	5484	2621	5.19[2]
Average cost of farm yard manure (Rs/ha)	1626	0	
Average cost of insecticides (Rs/ha)	5378	7458	2.57[2]
Average volume of irrigation applied (m^3/ha)	942	1516	4.22[2]
Average annual cost of irrigation water (Rs/ha)	1141[3]	200	
Average annual water charges (Rs/ha)	385	678	
Average cost of irrigation water (Rs/ha)	1526	878	2.24[2]
Average hired labor use (mandays /ha)	37	0	
Average Family labor use (mandays/ha)	86	221	6.51[2]
Average Cost of hired labor (Rs/ha)	2940	0	
Average total cash costs of inputs (Rs/ha)	22754	20901	0.85
Average gross value of product (Rs/ha)	57183	68118	1.89[1]
Average net value of Product (Rs/ha)	34429	47217	2.50[2]
Gross water productivity (Rs/m^3)	61	45	
Net water productivity (Rs/m^3)	37	31	

1 US $ = 57.25 Pakistan Rupee

Notes

[1] significant at 90% confidence level

[2] significant at 95% confidence level

[3] average cost of pumped groundwater used to supplement canal water

BENEFITS AND COSTS OF USING WASTEWATER AGRICULTURE TO FARMERS

The wastewater farmers saved on the most important costs, which need to be paid in cash, such as groundwater, fertilisers, and hired labour. This made their total costs slightly lower than those of the canal-irrigated farms (see Table 1). However, the difference of the total cash costs was statistically insignificant. The major advantage of the wastewater farms was in the higher production and, the gross value of their products remained significantly higher than the canal farms. The gross margins of wastewater farmers were also significantly higher than those of the canal-water farmers, because vegetables brought higher returns to wastewater farmers.

The majority (80%) of the wastewater-irrigating farmers viewed water availability as sufficient to raise crops they had planted, while 70% of the canal-irrigating farmers felt that the water supply remained insufficient. The average annual water availability for the wastewater irrigators was 1,516 cubic meters/ha compared to the canal irrigators who could only use 942 cubic meters/ha. The cost of irrigation water, which include the cost of surface and groundwater, and the water tax on crops, was significantly higher for the canal irrigators than for the wastewater irrigators.

The wastewater farmers grew high value, short duration crops such as vegetables (especially cauliflower) and fodder, and had significantly higher cropping intensities compared to the canal farms, who could only grow wheat and cotton, or sugarcane and some vegetables. Of the canal-irrigated farms, vegetables covered only 18 percent of the area while wastewater area vegetables covered 83 percent of the cropped area.

The wastewater farmers did not need hired labour, as they could utilise their family labour. The canal-water farms used on average 37 days of hired labour per year per ha. The family labour input was significantly higher on wastewater farms than on the canal water-irrigated farms. The farmers at the wastewater farms used almost eight months per ha of family labour. Use of family labour saved the wastewater farmers roughly 50% of the

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Watercourse carrying municipal effluent to agricultural lands in Haroonabad, Pakistan

There is scope for increased productivity of wastewater

gross margin of a canal-irrigated farm. The wastewater farmers viewed availability of the entire family employment on the same farm as a valuable opportunity. Due to the significantly lower fertiliser application by wastewater farmers, the costs of fertilisers were also significantly lower in wastewater farms. The value of wastewater is reflected in the land rents for wastewater farms, which on average were 3.5 times higher than those of the canal-water farms. The difference was found to be statistically significant.

The average cost of agricultural operations per unit of land was significantly higher at the wastewater farms as compared to that of the canal-water farms. The data also showed a statistically significant difference in costs on insecticides in the wastewater farms as compared to the canal-water farms. The wastewater farmers could only grow a limited number of crops, such as spinach, chillies, pumpkins, round gourds, egg plants, onions, tomatoes, cauliflower, and fodder. The limitations included lack of freshwater for washing, to blackened tuber and root crops, to more vegetative growth and less fruit formation.

In addition, the marketable surplus of individual farmers in small towns was found to be too small to export these vegetables to large city markets. As a result, the farmers tend to sell vegetables in the local market, where demand is rather limited and inelastic. Because they also lack storage facilities, farmers have to sell their produce as soon as it is harvested due to the very perishable nature of vegetables grown. All farmers growing similar crops and selling them during the same period in a rather small market has led to excess supply particularly during peak seasons, affecting prices and therefore returns to the farmers. At the start of the harvesting season when supply is low, prices are high, but as production approaches its peak, the price falls to its minimum. There is therefore quite a visible reaction of prices to production.

SOCIAL BENEFITS AND COSTS OF WASTEWATER AGRICULTURE

Wastewater irrigation could potentially lead to bacterial and worm infections to workers, while accumulation of materials can lead to salinisation of land (van der Hoek *et al.* forthcoming). However, concentrations of heavy metals fell within the FAO standards for irrigation.

Due to water scarcity in Haroonabad, only two-thirds of the allocated irrigation water was available to farmers bordering on the canal feeding this area. The wastewater-using farmers had however freed up some of the canal water, while still generating an additional net value. Thus, each cubic meter of wastewater used for irrigation not only released three to four times the amount of fresh water for use elsewhere, but it also generated an additional net monetary gain for the society as a whole, indicating an opportunity for additional private and social benefits.

The overall gross and net water productivity of the wastewater farms was lower than that of the canal-irrigated farms. Limited canal water supplies coupled with expansive and poor quality groundwater forced canal-irrigating farmers to use less water for crops. In contrast, most of the wastewater farmers had sufficient water available in a reliable and flexible manner, and at almost no cost. On top of this, the wastewater had almost no opportunity cost, as it could not be delivered to another farmer, alternate use or area due to the absence of required physical infrastructure. Therefore, farmers tended to over-apply wastewater, keeping the gross and net value of wastewater below the canal water. There is a scope for water savings for wastewater, and thus increasing productivity of wastewater by regulating its allocation and improving the mechanisms for conveyance and distribution.

Van der Hoek *et al.* (forthcoming) indicate opportunities for reducing soil pollution from continuous wastewater irrigation through spreading wastewater thinly over larger areas. This however requires investment, as well as interaction with and participation of all the farmers located in the vicinity of disposal stations, in the planning of sewage schemes through social mobilisation processes [(2)].

Notes
(1) Most of the tertiary irrigation channels of the canal network in the Punjab province are state channels (*Sarkari Khal*), to which farmers connect their private channels. Earlier experiences in collective action at the tertiary level of the irrigation system in Pakistan suggest that it has been extremely difficult for farmers to cooperate on building and sharing new irrigation channels or changing the route of the channel, even with considerable facilitation from the state (see for instance Malik *et al.* 1996), unless the channel was state property.
(2) Action research around the area has already proven that if appropriate social organisation methodologies are followed, farmers show an eagerness to engage in a dialogue for water resource sharing (Hamid and Hassan 2001). The returns to such initiatives are usually higher than the costs involved (Hassan *et al.* 1999). The users' organisations share the natural resources more equitably under their own organizations than controlled by the state (*ibid.*).

Among the approximately two million residents of the Metropolitan District of Quito, Ecuador, 45% live in conditions of poverty, and 12% in destitution (PNUD, 2002). These conditions are linked to and aggravated by the economic crisis produced by the structural adjustment policies of the last three years.

César Jaramillo

The neighbourhood "Musculos y Rieles" in the periphery of Quito

Trust Funds as Financing Mechanisms for Participatory Urban Agriculture

Over the course of this period the process of of "*dollarisation*" resulted in a 120% rate of inflation, an unemployment rate of 29.5%, and underemployment of over 60% of the economically active population. The aggressive process of internal migration (64% of the population of the country lives in urban areas) has resulted in a constant and growing transfer of poverty from the countryside to the city. This has resulted in an increase of unemployment and self-employment through activities traditionally considered to be part of the "informal economy".

THE "AGRUPAR" PROGRAMME

The local government has institutionalised initiatives to promote sustainable human development and to fight poverty and social exclusion. Beginning in January 2002, the Municipality of Quito created the Participatory Urban Agriculture Programme "AGRUPAR", which falls under the Metropolitan Department of Sustainable Human Development (MDSHD).

AGRUPAR aims to combat the disproportionate impact of the economic crisis on the poorest urban populations, especially female heads of household. It is designed as a participatory tool in the formulation and implementation of policies and projects, focusing on:

a) the generation of income and employment;
b) forms of guaranteeing urban food security; and
c) the ecological protection of natural resources.

With the aim of increasing efficiency and serving the community better, the metropolitan government has decentralised its work among eight Zonal Administrations, which are responsible for executing municipal policies, managing and controlling urban land use, and collecting property taxes. These zones have the necessary resources (human capital, land, water and community organisation) to undertake the participatory programmes involving organic production, processing and commercialisation of agricultural products.

The support of the Mayor's Office for the programme is a guarantee for favourable legislation and institutional motivation to facilitate access to credit, training, and infrastructure.

AGRUPAR has begun with the implementation of communal demonstration gardens on private, public, and municipal land. In the case of gardens on private and public land, land-use agreements are signed to assure access to the land for at least two years. In the case of gardens on municipal land, a small rent is charged. The demonstration gardens are designed to serve as examples and training spaces for community members participating in the programme, with the idea that they will reproduce the experience in their homes of organic family gardens and the raising of small animals.

Training is provided in the form of internship experiences on organic farms. With the goal of strengthening the programme, various agreements of co-participation have been signed with national and international organisations to provide training, technical assistance and seeds, and to assist with the commercialisation of products. These organisations include the Urban Management Programme, the World Food Programme, the Quito Forestation and Reforestation Programme, and supermarket chains, amongst others.

THE "PRO-QUITO" PROGRAMME

For the implementation of the organic family gardens and for the development of micro-enterprises, AGRUPAR provides participants in the programme with credit through the municipality's "Pro-Quito" Economic and Social Inclusion Development Fund Programme. The objective of this fund is to encourage productive investment and the creation of employment through the financing of innovative productive activities and/or services to micro-enterprises in the city.

"Pro-Quito" was born through a trust fund (see Box 1 for definition) made up of resources from the municipality. The organisation of the resources is realised through Cooperatives and NGOs. A Trust Fund Board decides on resource allocation and determines the final beneficiaries. In this board, a delegate from the Mayor's Office, the director of the MDSHD and representatives from the Technical Committees (who regulate the activities of each project) have a seat. The municipality contributes the funding and

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collaborates with additional partners who can assist with resources for special sub-accounts.

The Co-operatives and NGO's channel the resources to individuals or groups of entrepreneurs living below the poverty line and who do not have access to formal bank credit. The maximum amount of credit for each operation is set by the Trust Fund Board with a limit of $1,500 per family for agricultural production and $6,000 per commercialisation project. "Pro-Quito" counts on the Zonal Administrations for promotion and diffusion of the Programme, and to channel requests for credit through the Development Operators.

The National Financial Corporation is the trustee in charge of administering the resources directed to the development operators. These operators are selected on the basis of criteria of operative efficiency, management capacity, resource management experience, social commitment, and location within the Metropolitan District. The Operators are in charge of directing the operations and credit, training and technical assistance, evaluating credit recipients, and managing follow-up, with a vision towards sustainability.

The economic inclusion is closely linked to social inclusion

The Pro-Quito Trust Fund recognises the Municipality of the Metropolitan District as the original fund contributor and promoter of this initiative. But the Pro-Quito Trust Fund guarantees transparent, responsive, and efficient management of resources, as well as the sustainability and realisation of the programme, as changes in political office do not affect its policies and goals. In addition, it assures that the financial resources not used at the end of each fiscal period are not lost.

As a result, the trust fund is the most suitable instrument for gaining the confidence of public and private entities that could join as additional contributors and provide technical and economic resources.

PRO-QUITO AND AGRUPAR

The AGRUPAR Programme has established a strategic alliance with the "Pro-Quito" Trust Fund for the execution of two micro-credit programmes: that of the family gardens and that of the verticalisation (commercialisation) of excess agricultural production through communal and family micro-enterprises. "Pro-Quito" has determined various strategic lines of development, including urban agriculture, through a line of credit called CREDIAGRUPAR that is designed to include repayment terms and channeling of funds based on production schedules and processes. This facilitates the provision and timely repayment of credits, which benefits the target population of AGRUPAR.

Credit facilitates the generation of employment and the reduction of economic vulnerability, which can result in improved levels of income and standard of living. Another impact is the increased level of community and family participation in decision-making, and providing opportunities for self-sufficiency and increased self-esteem and confidence. The economic inclusion through access to credit is closely linked to social inclusion.

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In conditions of economic crisis such as those presently experienced in Ecuador, the effect of the provision of credit can moderate the, often severe, fluctuations in access to resources at the household level.

For the Municipality of Quito the development of a micro-credit program such as this is a social investment. Although the direct economic returns of the program may not be as high as they would be on the financial market, combined with the social returns, the investment is well worthwhile. Credit programs are part of a larger strategy of poverty alleviation and help to fulfil long-term social goals such as self-determination, and community economic independence. Although the fight against poverty must take place at many levels and through many approaches, the use of micro-credit is a solid support and launching point from which to work.

The Pro-Quito/AGRUPAR alliance is an effective, efficient, and opportune instrument to alleviate urban poverty, improve the urban environment, generate income, and promote citizen participation.

The Trust Fund

A trust fund is based on an act of confidence, in virtue of which an individual or legal entity provides another with one or more goods with the expectation of compliance with a determined result, established in a trust fund contract. This result may be for the benefit of the fund contributor or of a third party, whereby as a consequence of the trust fund contract, a specialised and duly authorised entity (the trustee) agrees to undertake its best effort to achieve the result determined by the contributor. The trustee maintains total autonomy between its own capital and the goods received. In addition, a separation is also maintained between the goods of each trust fund contract in order to avoid confusion. This is known as autonomous capital. The actors in this mechanism are:

- the ***Fund Contributor***; an individual or legal entity that entrusts to the trustee a specified management of one or more of its goods for the achievement of a result, in accordance with the norms set out by the fund contributor;
- the ***Trustee***; a special and legally recognised entity authorised to administer funds and trust funds and exercise legal representation, and
- the ***Beneficiary***; the person for whose benefit the trust fund is developed and the results achieved, and who may be the very contributor or the person(s) designated by the contributor.

Those individuals or legal entities that accept and take on the arrangements indicated in the trust fund contract are additional contributors.

The trust fund is a flexible and legal arrangement of extraordinary versatility that adapts to the needs of the fund contributors and that is characterised and justified by the development of its specifications. It is a truly adaptable tool whose conceptual limit is marked by the creativity of its designer, obviously within the bounds of permissibility and legality.

Studies calculating the contribution of urban agriculture to income are unlikely to accurately estimate the quantities of food produced because informal agricultural activities are not generally included. One estimate (Blair et al. 1991) calculated that the 30,000 or so allotment holders in London produce nearly as much fruit and vegetables in weight terms as horticultural enterprises. Prices are also difficult to measure due to fluctuations and variations in different markets.

Sustain

Reasons for allotment gardening are therapy and supply of fresh produce

Costs and Benefits

a discussion paper of Urban Agriculture in East London

This paper explores some of the current issues and economic aspects of urban and periurban agriculture in East London. A formal analysis of the economic costs and benefits is beyond the bounds of this paper. It is intended, however, to lead to discussion of the need to support a re-development of a sustainable, food economy in East London, support for sustainable, social enterprises, and a rethink of our cities' relationship to food.

CURRENT SITUATION AND ISSUES

London's '*ecological footprint*' [1] is estimated to extend to 125 times the capital's surface area with food accounting for around 40% of this (Giradet 1995). London's residents, visitors and workers, consume 2.4 million tonnes of food and produce 883,000 tonnes of organic waste per year (Murray 1998). The food industry makes a significant contribution to London's Gross Domestic Product (GDP) with around 11% of all jobs found in the food sector (Heasman 1999).

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The Lea Valley region of East London typifies a declining industrialised horticulture. This once thriving area for food production has shrunk since the war due to the relative scarcity of labour and competition from imports from an increasingly globalised food economy. The industry now covers an area of 120 hectares under glass. It has a high productivity with 200 or so horticultural enterprises ranging in size from less than an acre to 20 acres with production nearly always automated and hydroponic, often in peat based media and using artificial fertilisers.

This remnant of urban agriculture could provide an opportunity to redevelop, modify, and diversify the industry towards a more sustainable system. This would entail further improvements in technology, conversion to organic production, development of sustainable, social enterprises, and production for local London markets (such as Farmers' markets) - utilising the existing infrastructure and changing the modes of production and food system in London.

Urban agriculture in East London is generally no longer a response to crises or a '*coping strategy*' as it once was. Commercial activities are primarily motivated by profit although some producers, particularly organic, have a 'philosophy' attributed to their lives and see it *more* than simply a way to make money. Agricultural activities do provide a way for low-income groups to have a supply of fresh fruit and vegetables along with many of the other benefits, con-

The case of Geoff

Geoff Snelling has been an allotment holder for over 15 years. He has two 10-rod plots (equivalent to twice 30'x 90' or about 9 x 27 m^2) in Redbridge. He grows a very wide range of soft fruit and vegetables and composts all waste. He tends to grow mainly higher value/priced produce such as asparagus, loganberries, chillies, and rare potato varieties. His primary reasons for allotment gardening are therapy and a supply of fresh organic produce. Geoff and his wife have a mainly vegetarian diet and nearly all their fruit and vegetable requirements come from the plot. He gives away any surplus produce to his family or exchanges it (barters) with other plot holders. Geoff spends between 30-35 hours per week gardening in the summer, and between 10-15 hours in the winter. He pays £52 (=US $81 – July 2002) per year in rental for the two plots to the allotment association.

Thanks to Geoff Snelling, Jenny Usher, and Claire Pritchard and Vicki Hird of Growing Communities for their contributions to the case studies. This paper does not necessarily represent the views of Sustain or any of Sustain's members.

tributing to household food security and nutrition. This is of particular importance to communities in East London experiencing problems in the availability of, and access to, affordable fresh food sometimes referred to as '*food poverty*'. Recreational gardening and community growing initiatives are not financially profitable especially when the opportunity costs of alternative labour activities are considered.

There are no subsidies available under the European Union's Common Agricultural Policy for horticulture or small-scale sustainable schemes. This factor has contributed to the lack of sustainable food and horticultural enterprises on the urban fringe producing for local London markets. Agriculture in the city is under extreme pressure from other, more lucrative, land-use demands such as housing and work spaces. This is expected as cities grow, but partly because of planning regulations this has meant holdings on the urban fringe continue to be large, producing 'bulk' crops (cereals, potatoes, etc.) for national and international markets, rather than transforming into small-scale holdings producing horticultural crops for local food industries and markets.

Processing and storage infrastructure, and markets specifically set up to deal with local food within a sustainable regional system are rare and underdeveloped in London. However, processing enterprises themselves need a reliable supply from producers to ensure regularity, efficiency and productivity. Appropriate storage is important to ensure regularity and a balance to seasonal variations. There is some vertical integration both up- and downstream from markets to production and vice versa *(see Jenny Usher's case)*. However, this is relatively limited and more often enterprises and holdings are continuing to specialise in particular commodities and/or areas of the food chain. The eight farmers' markets in London contributed over £3 million last year (London Farmers' Markets Ltd 2001) to the income of the capital and more markets are opening all the time. Farmers must come from less than 100 miles away – double the usual distance rule of other farmers' markets but a great improvement on the 600 miles (or 965 km), which the average vegetable travels before reaching market (Envolve 2001).

Urban-rural links and urban agriculture could be an effective buffer in London to external economic '*shocks*' such as rapid increases in prices and problems with domestic supply caused by factors such as disease (like Foot and Mouth disease) and transport/energy crises. This buffer would assist the region's food security and add to the sustainability of the capital. It currently benefits the informal grower more in London because the multiples and wholesalers can easily source supplies from elsewhere within the global food market.

There is a rapid growth in the organic food sector in the UK but few domestic producers have been able to capitalise on this. Domestic supply of organic produce is increasing at a slower rate than demand with the result of more imports of organic foods from Europe and elsewhere (Soil Association 2001). Longer supply chains may increase the risk of fraud in the sector affecting sales and confidence still further. The '*organic*' label only describes the method of production and not the journey or transformation the food has taken. However, any '*local*' or '*sustainable*' labeling/certification proposal must be approached with caution.

Although local food production in London currently accounts for a tiny fraction of the total amount of food consumed, it could potentially provide much more. One estimate (Garnett 1999) calculated that urban farming in London could supply up to 20% of Londoners' demand for fruit and vegetables, along with significant amounts of other foods.

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Proudly showing produce from own garden

COSTS AND BENEFITS

Employment and training opportunities could be increased in London's food economy and in auxiliary industries such as plant nurseries, manufacturers and auxiliary businesses. Agricultural activities in the city, especially when organic, generally have higher labour demands compared with more industrialised systems. However, unemployment in East London, as in the UK as a whole, is no longer such an important political issue or social problem as it was during the 1980s and 1990s (although there are some areas in East London with very high unemployment rates still). More critical to food enterprises is the scarcity of unskilled labour, shortage of skilled labour, and high wage costs. Training in horticulture, food processing, etc. will develop labour skills and increase participants' 'employability'. The close proximity to home for these gardeners saves time and effort and reduces the incidental costs incurred by travelling to and from sites.

The case of Jenny

Jenny Usher is an organic grower in Essex, 20 miles from London. Jenny farms 3.2 hectares producing herbs, soft fruit, vegetables, greenhouse crops, and top fruit – although no bulk crops such as potatoes, carrots, etc. Jenny's own produce accounts for about 10% of all the produce she sells (40% in summer, 5% in winter). She buys in additional produce from wholesalers and sells through farm gate sales, a box delivery scheme (30 boxes per week) and the Spitalfields' Organic Market and other farmers' markets (accounting for 52% of turnover). The growth in the retail of organic foods by the major supermarkets is undermining the markets at which she has traditionally sold. Jenny has a turnover of about £100,000 per annum, and usually breaks even, although she sometimes makes a small net profit. Jenny also notes that the cost of transport and loss of yields due to pests are significant threats to profitability. Jenny spends over 40 hours per week working, and, aside from a few casual workers, she employs one person for 35 hours per week during the summer and 18 hours in the winter.

The case of Growing Communities

Growing Communities is a well-established organic box scheme in North East London. The group distributes 180 or so boxes per week mainly to families, with 20% of customers having low incomes. The group sources supplies from a farm in Oxfordshire, farmers in East Anglia, and elsewhere in the summer. The group also buys from wholesalers in the winter but has a policy of not buying produce from outside Europe except bananas. A typical 'veggie' box is delivered weekly and costs £35 per month. Fruit bags cost £78 per month. The group is starting to do 'salad bags'. Growing Communities has 8 part-time staff and 2-5 volunteers. The box scheme is considered to be financially sustainable and makes a small surplus, which is reinvested in the scheme.

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Employment and training opportunities could be increased

External economic benefits of urban agriculture include cost savings to various sectors including waste management, and reduced cost of transport. Recycling organic wastes reduces the municipal authorities' potential costs associated with waste disposal and landfill. London's agriculture could play a major role in any municipal authorities' waste minimisation strategy as each year disposal of organic waste (mainly through land fill) costs the authorities approximately £66 million per year [=$110 million/year] (Mayor's office, 2001).

Further cost savings may accrue to municipal authorities and the private sector through the reduced need for storm water infrastructure, water treatment, and regulatory systems, and lead to possible improvements in the health of the population and productivity of labour. Thames Water has recently spent £350 million on an Advanced Water Treatment (AWT) system together with a pesticide reduction campaign to reduce the number of pesticide test failures in drinking water (Thames Water Ltd 2001). The internalisation of these external costs would produce cost savings to households and the municipal authorities, and encourage more sustainable forms of farming.

New agricultural enterprises in the city may incur very high initial start-up costs. The cost of land, machinery, labour, and other inputs can be a significant barrier to entry because high initial capital and labour inputs are needed to be able to compete with existing enterprises and imported produce. Cost savings of urban agriculture are not generally 'internalised' and will accrue to other sectors. They may also occur over a number of years and hence are likely to be heavily discounted.

Other barriers to entry to urban agriculture in East London include underdevelopment of downstream activities (processing, storage, markets, etc.) and competition from food imports. The cost of transportation of produce to markets can also be a major factor in determining economic viability.

OPPORTUNITIES AND CHALLENGES

Informal food growing in London makes a significant contribution to the economy and sustainability of the capital, as well as to household food security. It is estimated that the 30,000 or so allotment holders in London produce almost as many vegetables as commercial activities at about 7,460,000 tonnes per year whilst many people also grow food in back gardens and window boxes (Garnett 1999) Policies are needed however to address the concerns of urban gardeners, including soil contamination, security of land tenure, municipal support, and distribution of, and access to, areas for food production.

Strategic support from local and regional authorities including the Greater London Authority (GLA) and London Development Agency (LDA) is essential. GLA strategies, monitoring and research of urban agriculture and LDA funding for development of sustainable activities would encourage food sustainability in the capital – as would changes to, and modification of, 'less sustainable' enterprises and the 'mainstream' food economy. The GLA has recently set up a working group looking at food and food issues in the capital, including urban food growing.

There also exists an independent network in London called London Food Link which is engaged with the GLA working group and which encourages sustainable urban food production on allotments and fringe farms.

There are demand-led opportunities in London for urban agriculture and horticulture specialising in niche and other products such as; fruit and vegetables, eggs, dairy, poultry, meat and fish (Garnett 1999). The demand-led opportunities need to be matched, however, by supply-led growth in more deprived areas to encourage equity of access and affordability between different social groups.

A major investment programme in the derelict and dilapidated infrastructure of the Lea Valley region and other traditional areas for food production is necessary to revitalise this once thriving industry.

Note

(1) *Ecological Footprint* –the area and resources providing goods and services to a city or region

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ERNASIA (Environmental Research Network Asia) is an independent, multi-disciplinary research network that provides an international forum for academic co-operation, exchange and debate on environmental problems in Asia. On this website, information is provided on research projects, conferences, seminars and other events. In addition, you can search in, and submit to, expert and reference databases, as well as subscribe to the ERNASIA newsletter and mailing list

www.urbanag.info
Urban Agriculture Online is a new magazine and will feature two principal streams of information: in-depth articles on commercial urban agriculture and articles on science and technology and policy-making in urban agriculture. The philosophy is that a great deal of valuable information is currently denied to Internet publishing because of the copyright protection issue. "Urban Agriculture Online" will be available on subscription from July 1, 2002.

www.fao.org/wssd/SARD/SARD3_en.htm
In preparation for the World Summit on Sustainable Development (starting in Johannesburg on 26 August), FAO is sponsoring an electronic forum on sustainable agriculture and rural development. The forum aims at developing initiatives on access to resources, good agricultural practices, and fair conditions of employment in agriculture.

www.ems-sema.org/castellano/proyectos/solidaria/ppp/eng_index.html
The final reports from the "Program Public-Private Partnerships for the Urban Environmental Management in Latin America and the Caribbean: towards new financial mechanisms and new institutional models" are available at this site.

www.bestpractices.org/
The Best Practices and Local Leadership Programme (BLP) is a global network of institutions dedicated to the identification and exchange of successful solutions for sustainable development. The programme's database contains over 1,150 proven solutions from more than 125 countries to the common social, economic and environmental problems of an urbanising world. It demonstrates the practical ways in which communities, governments and the private sector are working together to improve governance, eradicate poverty, provide access to shelter, land and basic services, protect the environment and support economic development.

http://www.foodaid.org/~jmarshall/fam/main.cgi
The Food Security Resource Centre's Online Database includes more than 8,000 items on food aid management. It contains materials on food security, monitoring and evaluation, monetisation, local capacity building, participatory approaches, agriculture, integrated pest management, commodity management, maternal/child health, nutrition, child survival, water and sanitation, ethics, and biotechnology.

www.ipes.org/aguila/
The new website of the Latin American Network on Research in Urban Agriculture, AGUILA, is now accessible. Also on this site, you can view and download the Spanish version of the *UA-Magazine*.

www.ifpri.cgiar.org/training/newsletter/2002/train_news_0204.htm
Information provided in this newsletter is a service of IFPRI (International Food Policy Research Institute) and is retrieved from brochures, websites, list servers, or list server members. To receive the information by e-mail: join the list server and send an e-mail message to LISTSERV@CGNET.COM. In The body of the message write SUBSCRIBE IFPRI-TCSP <your email address>. or contact either Valerie Rhoe at v.rhoe@cgiar.org or Suresh Babu at s.babu@cgiar.org.

http://www.wiwi.uni-bremen.de/iwim/africa/index.htm
This year´s edition, volume 9, of the "African Development Perspective Yearbook" will deal with "African entrepreneurs and Private Sector Development". On this site you will find the call for papers and back issues.

http://www.gg.rhul.ac.uk/Kumasi/
This part of the website of the Centre for Developing Areas Research (CEDAR), of Royal Holloway University of London, gives information of the research in Kumasi, Ghana and the discussion papers presented at workshops.

www.rcdsuccess.com
USDA, in cooperation with the National Association of Resource Conservation and Development Councils, has just launched an interactive website that will collect and make available Success Stories of Sustainable Agriculture, Forestry, and Community Development activities and projects, both domestic and international (with US Partnerships).

www.newvillage.net/
New Village is a Journal published by the national organisation, Architects/ Designers/ Planners for Social Responsibility (ADPSR) and is written for practitioners and citizen activists, alike. Each theme-focused issue offers more than a dozen articles, plus useful resources, on the diverse aspects of community building. Issue 2 deals with Community Scale Economics, with the following topics on Zoning: Greenmarkets; Urban Aquaculture; Urban Agriculture.

www.pps.org/
Project for Public Spaces is a non-profit technical assistance, research and educational organisation. Its mission is to create and sustain public places that build communities. Since its founding in 1975, the organisation has worked in over 1,000 communities within the US and abroad, helping people to make their public space grow into vital community places.
You can read the free newsletter, *Making Places* at ***http://www.pps.org/newsletter/ current.htm***

www.sustainabledevelopment.org/blp/awards
Every two years, up to 10 outstanding initiatives receive the Dubai International Award for Best Practices to Improve the Living Environment (DIABP), a biennial environmental award established in 1995 by the Municipality of Dubai, United Arab Emirates. Those initiatives meeting the criteria for a Best Practice are included in the Best Practices database.
You are encouraged to disseminate information on Dubai International Awards for 2002 to all your partners and contacts.

EVENTS

FIFTH MEETING ON ORGANIC AGRICULTURE (HAVANA, CUBA)

27-30 May 2003

Organised by the ACTAF (Cuban Association of Agricultural and Forestry Engineers), this conference will discuss new experiences related to integrated systems of natural resource management, appropriate technologies, social and economic aspects, environmental aspects, and the contribution of (organic) urban agriculture to sustainable urban development. The language is Spanish. More information: Nilda Pérez Consuegra: nilda@isch.edu.cu

WATER, POVERTY, AND PRODUCTIVE USES OF WATER AT THE HOUSEHOLD LEVEL (JOHANNESBURG, SOUTH AFRICA)

21-23 January 2003

This International symposium will discuss practical experiences, new research, and policy implications, from innovative approaches to the provision and use of household water supplies. From watering livestock to brewing beer, in rural, urban and peri-urban environments water is a crucial enabler of economic activity – particularly for women and the poor. Proposals for papers reporting on practical experiences, policy initiatives or the findings of research projects are invited. Please contact one of the symposium organisers: IRC International Water and Sanitation Centre, Delft, The Netherlands (Dr PB Moriarty : moriarty@irc.nl); or the Department of Water Affairs and Forestry, South Africa (B Schreiner or D Versfeld).

WASTEWATER USE IN IRRIGATED AGRICULTURE: CONFRONTING THE LIVELIHOOD AND ENVIRONMENTAL REALITIES (HYDERABAD, INDIA)

11-14 November 2002

The International Water Management Institute (IWMI) will be convening a meeting of minds workshop with the objective to critically review experience with the widespread use of untreated wastewater in agriculture focusing on livelihoods of the poor, and health and environmental risks. The workshop will begin to bridge the divide by setting up a focused discussion on detailed case studies including the presentation of data on water resources and quality, agricultural production, human health and ecological impacts.

GREEN CITIES, SUSTAINABLE CITIES CONGRESS (MIDRAND - JOHANNESBURG, SOUTH AFRICA)

18-21 November 2002

The congress organisers, who include the City of Johannesburg, the Department of Water Affairs and Forestry, and the South Africa Local Government Association, invite leaders and stakeholders to discuss the following subjects: Sustainable Urban Greening and Sustainable Development; Social Implications; Poverty Alleviation and Economics; Technical Aspects.
For more information, contact the Green Cities Congress Secretariat: Van der Walt & Co, Randburg, South Africa: Tel: +27 11 789-1384; Fax: +27 11 789-1385; e-mail ierm@vdw.co.za; www.ierm.org.za/greencities/

GREAT MARKETS, GREAT CITIES CONFERENCE IN NEW YORK CITY (NEW YORK, USA)

November 9-11, 2002

The 5th International Public Market Conference of the Project for Public Spaces will be held this November in New York City. The conference will celebrate the role of farmers markets and indoor public markets in revitalizing towns and cities across the U.S. Three hundred and fifty participants are expected for the three day event. The conference is sponsored by the Ford Foundation. "Great Markets, Great Cities": http://208.45.47.25/PMC.htm

INTERNATIONAL LEARNING WORKSHOP ON FARMER FIELD SCHOOLS (FFS): EMERGING ISSUES AND CHALLENGES (YOGYAKARTA, INDONESIA)

21-25 October 2002

This international Learning Workshop aims to discuss experiences; examine institutionalisation and up-scaling and identify opportunities for the further development of the FFS approach. Please contact the organisers CIP in Manila: either by email to cip-manila@cgiar.org or by fax to +63 49 5361662.

THIRD MEETING OF THE REGIONAL ASSEMBLY OF THE AGUILA NETWORK (LIMA, PERU)

23-25 September 2002

This assembly will discuss ongoing activities and plan next year's strategy for the very active network on urban agriculture. See for more information: http://www.ipes.org/aguila

WORKSHOP ON URBAN AGRICULTURE (LIMA, PERU)

18-20 September 2002

Also in Lima, this workshop, organised by the Cities Feeding People Programme and hosted by ITDG, Peru, will review results, impacts and lessons learned from a second generation of urban agriculture projects in Latin America and the Caribbean. The proceedings of the workshop will be published in early 2003 and copies will be available from the Cities Feeding People Program.

WORKSHOP ON POLICY BRIEFS (LIMA, PERU)

11-13 September 2002

The municipality of Villa Maria del Triunfo of Lima, Peru, together with IPES, UMP-LAC, and IDRC, will organise a workshop to validate a series of new policy briefs on urban agriculture, featuring themes such as gender, micro-credit, waste and water recycling, urban planning, food security, and commercialization. Mayors and technicians from ten Latin American municipalities will attend the event

EXCHANGE MEETING AND SEMINAR ON URBAN AGRICULTURE (ATH, BELGIUM)

23-26 September 2002

This seminar is organised by the Haute École Provinciale du Hainaut Occidental (Ath), Institut de la Vie (Bruxelles) and PRELUDE international (Bruxelles). It will bring together about 30 farmers and experts from East, Central and West Africa and from the North with the intention to share experiences in urban agriculture, discuss possibilities of promoting urban agriculture, and building and consolidating partnerships and networks. The programme foresees the presentation of papers and case studies, ending with the formulation of recommendations and conclusions and the drafting of a common charter of Urban Agriculture.

LEADERSHIP FOR TRANSFORMATION AND ORGANISATIONAL CHANGE IN AFRICAN AGRICULTURE PROGRAMME: LEADERSHIP SEMINAR (BULAWAYO, ZIMBABWE)

1-11 September 2002

The seminar seeks to determine and devise strategies for managing change leading to the transformation of African Agriculture in the rural as well as urban environments. The seminar marks the beginning of a year-long programme aimed at equipping change agents with leadership competencies that will enable them to effect change in the areas they work. African Case Studies and Thematic Issues shall be used to address some topical issues in African Agriculture. Faculty of Agriculture, University of Zimbabwe: 263 4 303211 Ext 1158; E-mail leader@africaonline.co.zw

WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT (RIO EARTH SUMMIT +10) (JOHANNESBURG, SOUTH AFRICA)

26 August-6 September 2002

Ten years after the World Summit on Sustainable Development in Rio, Brazil, this follow-up Summit in Johannesburg will bring together tens of thousands of participants to focus the world's attention and direct action will be focused on taking stock of the environmental situation in the results of agreements made, to be summarised in the various chapters and subsequent conventions. National and regional preparations are already in full swing. The *UA-Magazine* is preparing a special issue on Urban Agriculture for this event. More info is available at: http://www.un.org/esa/agenda21/ or http://www.earthsummit2002.org/ or http://www.fao.org/wssd/contr_en.htm

INTERNATIONAL CONFERENCE ON URBAN HORTICULTURE: PEOPLE, PLANTS, QUALITY OF LIFE (ZURICH, SWITZERLAND)

2-6 September 2002

The aim of the conference, organised by the University of Applied Sciences Waedenswil in cooperation with the International Society for Horticultural Science, is to present and discuss visions, innovations, research themes and solution concepts for urban green areas. Garden design and plant utilisation as well as the interactions between people and designed nature form the central themes of the conference. Specifically, the five themes are: Plants and Society; Public Green; Plant use and Landscaping; Assortment Development, Evaluation and Production; and Ecological Engineering. For more information, visit: http://www.urbanhorticulture.ch/index_en.htm or send an e-mail to: conference@hortikultur.ch .

CONFERENCE ON URBAN AGRICULTURE AND TOURISM AGRICULTURE, JOINTLY HELD BY MAINLAND CHINA AND TAIWAN PROVINCE (BEIJING, CHINA)

September 1-4, 2002

With rapid economic growth and urbanisation since the 1990s, urban agriculture, in particular tourism agriculture has increasingly drawn attention from various governmental agencies, farmers, investors and scholars in China. To exchange ideas and experiences in the development of urban agriculture and tourism agriculture between Mainland China and Taiwan, the Geographical Society of China, Taiwan Health & Management College and Taiwan University co-organise this conference, which is sponsored and managed by the Geographical Society of Beijing and the local Government of Yanqing County (Beijing Municipality). Contact: Shenghe Liu, Email: liush@igsnrr.ac.cn, Tel:86-01-64889279, or check the Website: http://www.gsc.org.cn/china/note/jichudili.htm (in Chinese).

IFOAM 2002 ORGANIC WORLD CONGRESS: CULTIVATING COMMUNITIES (VICTORIA, BRITISH COLUMBIA, CANADA)

21-28 August 2002

The IFOAM (International Federation of Organic Agriculture Movements) international congress will bring together representatives of the organic movement from around the world, and is open to everyone interested in organic agriculture and sustainable development - farmers, researchers, advisors, food processors, traders, certifiers, policy-makers and consumers. More information at: http://www.cog.ca or www.ifoam.org .

RUAF/IWMI ELECTRONIC CONFERENCE: AGRICULTURAL USE OF UNTREATED URBAN WASTEWATER IN LOW INCOME COUNTRIES

24 June-5 July 2002

Some of the findings in the Ouagadougou workshop mentioned above concur with contributions to this electronic conference organised by IWMI and RUAF. About 330 participants discussed the issue under two topics:

- *Strategies to ensure proper management by farmers*
- *Strategies to reduce industrial contamination*

Some 140 contributions related to the first topic, and 25 to topic 2 came from researchers, NGOs and municipalities. These and the thematic and case study papers can be found on the RUAF website: www.ruaf.org

WORKSHOP ON URBAN AGRICULTURE (DAKAR, SENEGAL)

12-14 March 2002

This workshop was held in Dakar and organised by the IAGU (Institut Africain de Gestion Urbaine). A report will be made available soon.

GARDENING IN THE CITIES OF WEST AFRICA: IMPLICATION FOR INTENSIVE INTEGRATED PRODUCTION SYSTEMS (SAVANA-SALY PORTUDAL, SENEGAL)

5-8 august 2001

(Agriculture Urbaine dans les Villes Ouest-Africaines: impacts des systèmes intégrés de production intensive).
This workshop in, was organised by ISRA / ITC / CRDI and the report is presently being printed.

GREEN AND PRODUCTIVE CITIES: SEMINAR ON URBAN AND PERI-URBAN AGRICULTURE IN CENTRAL AND EASTERN EUROPE (SOFIA, BULGARIA)

20-22 June 2002

Over sixty City officials and senior staff of sectoral government organisations, NGOs and research institutes from 15 countries in Central and Eastern Europe gathered in Sofia to discuss the results of a three-year project named "Soil and Water Management in Agricultural Production in Urban Areas (SWAPUA)". Project partners from Slovenia, Russia, Bucharest, Czech Republic and Rumania presented the results of an exploratory study on the presence, types and impacts of urban and periurban small-scale farming and gardening in ten cities. Representatives of FAO's regional office for Central Europe and WHO-Europe presented their experi-

ences and views on the role of urban agriculture in poverty alleviation and urban food security and nutrition. Also, the experiences gained in Randstad Holland and Hanover regarding the multiple functions of urban agriculture were presented. The participants concluded, among others, that urban agriculture is part of the socio-cultural, economic and ecological system of the city that has played and can play various important functions for the urban citizens. Finally, a large number of recommendations were formulated. Various participants announced that they would initiate discussion and actions on this subject after returning to their home country, since local authorities are largely unaware of the many potentials of urban and periurban agriculture. The proceedings will be published in August on the RUAF website and in hard copy. Also, the Policy Framework that was developed by the project will be made available on the website and in hard copy. For information on the seminar and the SWAPUA project, please contact: Henk de Zeeuw (ETC) at: h.dezeeuw@etcnl.nl; +31-33-4326039; or by post: P.O. Box 64, 3830 AB Leusden, The Netherlands

WORLD FOOD SUMMIT: FIVE YEARS LATER (ROME, ITALY)

10-13 June 2002

The World Food Summit: "Five Years Later", was held from 10-13 June 2002, in Rome, Italy. A special issue of the *UA-Magazine* has been prepared on the topic and can be downloaded in pdf format from the RUAF website (www.ruaf.org). See for more information: *http://www.fao.org/worldfood summit/english/index.html* or on the NGO Forum, parallel event: *http://www.forumfoodsovereignty.org/ingleseweb/inglesepage.htm*
Also food security related materials for the Summit are available on the Development Gateway: http://www.developmentgateway.org/foodsecurity/

STUDY VISIT/WORKSHOP: REUSE OF WASTEWATER IN URBAN AGRICULTURE, A CHALLENGE FOR MUNICIPALITIES IN WEST AFRICA (OUAGADOUGOU, BURKINA FASO)

3-7 June 2002

This study visit was organised by ETC Netherlands in conjunction with CREPA headquarters in Ouagadougou and financed by CTA Netherlands. There were 29 participants from nine West and Central African countries. Thematic and case study presentations were held alternated with field visits to urban and periurban agriculture sites. Three groups discussed health and environment related issues, socio-economic issues and legal institutional issues. Recommendations addressing municipalities, local organisations, the producers and the consumers were presented. Discussion centred on the definition of wastewater. Not all of this water is called or seen as wastewater since it is often a river, stream or lake. Further discussions covered perceptions, acknowledging that farmers (and consumers) themselves see very little to no problem in water quality, but define quantity and regular availability of water and products as much more important. The subject of hygiene and behaviour was discussed by the participants and provoked heated debates on cause and effect or transmission routes of bacterial infections. The general conclusion was that urban agriculture as a subject on its own, is not taken sufficiently seriously by authorities, although studies are available in nearly all countries in which its importance is demonstrated and even quantified. Information will soon be available on www.ruaf.org

NYANGA DECLARATION (NYANGA, ZIMBABWE)

4-7 June 2002

The delegates to the Urban Council Association of Zimbabwe's 61st Annual Conference, comprising of the Minister of Local Government, Public Works and National Housing, the Minister of State for the Informal Sector, Executive Mayors and Chairpersons, Town Clerks, Council Committees, Councillors, Heads of Departments, and other representatives, and local and international NGOs. They underlined that urban and periurban agriculture contributes to urban food security, poverty reduction, local economic development and sustainable urban development. In their declaration, the participants urged local authorities to promote urban agriculture in their cities, to develop appropriate incentives and other policies necessary. It was further suggested to include urban agriculture in government programmes. Non-governmental organisations and donors were requested to support these efforts financially and materially, and the private sector to invest in high value intensive urban and periurban agro-industries.

URBAN POLICY IMPLICATIONS OF ENHANCING FOOD SECURITY IN AFRICAN CITIES (NAIROBI, KENYA)

27-31 May 2002

This workshop was organised by UNHCS (HABITAT) in partnership with the FAO, IDRC and SIUPA (CIP-based Strategic Initiative on UPA). Some 100 participants form the region, from municipalities, councils, NGOs, universities and international agencies discussed the issue of Urban Food Security. Emerging dynamics in sustainable urban development have given rise to new policy issues that need to be addressed by urban planners, managers and other relevant decision-makers. The participants reviewed the contribution of urban agriculture to the overall food needs of cities in Africa and to urban poverty reduction in general. Policy guidelines were developed along four main areas: Urban food security and poverty reduction; Rural-urban food flows, internal distribution infrastructure and services; Urban and Periurban agriculture related issues on land tenure, land-use conflicts, planning and development (including technical extension and environmental management); and Credit and investment in urban and periurban agriculture. Results of the workshop are under preparation, while the output of the workshop on Credit and Financing will be disseminated widely through policy briefs and the *UA-Magazine*. Contact: Urban and Regional Economy Unit, Urban Economy and Finance Branch, UNCHS (HABITAT), P.O. Box 30030, Nairobi, Kenya. Tel: +254 2 624521; Fax: +254 2 623080; e-mail: rose.muraya@unchs.org.

FEEDING CITIES IN THE HORN OF AFRICA: DECLARATION OF ADDIS ABABA (ETHIOPIA)

7-10 May 2002

'Urban poverty and hunger are reaching alarming levels in cities of the Horn of Africa. Urban populations are expected to double in the next ten years, and action by governments, local authorities and the private sector is urgently needed to improve access to food by the urban poor.' This was the message from ministers, mayors and planners from the seven Horn of Africa countries (Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan and Uganda), who on the 10th of May signed a declaration recognising the problems and pointing to needed action. The signing ceremony came at the end of a three day workshop on 'Feeding Cities in the Horn of Africa'. For further information, please contact: Olivio Argenti, Focal Point, Food Supply and Distribution to Cities, FAO, Rome;

Tel: 0039-06-5705-5119; e-mail: Olivio.Argenti@FAO.org; or Michael Wales, Horn of Africa Food Security Initiative, FAO Investment Centre, Rome; Tel: 0039-06-5705-5432; e-mail: Michael.Wales@FAO.org.
See also: Web story: Serious commitment to fight hunger in the Horn of Africa at: http://www.fao.org/news/2001/010705-e.htm
Summary report: The elimination of Food Insecurity in the Horn of Africa: http://www.fao.org/News/2000/img/HoAsum.pdf

FEEDING ASIAN CITIES: PROCEEDINGS OF THE FAO-CITYNET-AFMA REGIONAL SEMINAR (BANGKOK, THAILAND)

27-30 November 2000
The proceedings can be downloaded at:
http://www.fao.org/ag/ags/agsm/sada/pages/ac/ac3701e.htm

VIRTUAL WATER FORUM

The International Water Management Institute (IWMI) is chairing a session in this forum on "Safe and sustainable reuse of urban wastewater in very low income countries". The intention of the session is to take a realistic view of this practice rather than ignore it presuming that all wastewater used is treated. Together with the output of the E-conference, this session on the Virtual Water Forum will be the subject of further in-depth discussion at the **workshop in Hyderabad** in November 2002, leading up to a broad based session at the **World Water Forum in 2003 to be held 16-23 March 2003 in Japan.**
More information: Dr Ing. Liqa Raschid-Sally. l.raschid@cgiar.org, International Water Management Institute, P.O.Box 2075, Colombo, Sri Lanka, Tel +94 1 787 404; Fax +94 1 786 854, http://www.iwmi.org.
he session can be accessed at the World Water Forum website http://www.worldwaterforum.org/for/ en/fshow.393 You can enter this session as a guest or register as a participant, in which event the WWF will send you the necessary ID and password.

URBAN AGRICULTURE ONLINE

As from July 2002, *Urban Agriculture Online* a new magazine will be available on subscription. The new magazine will be the world's first user of innovative Cashforcontent™ Internet publishing-for-payment software, which protects copyright material and intellectual property from unauthorised use. From July 1, contributors can enjoy low-cost publishing that pays from 50% to 60% royalties on revenues for their valuable material. The editor, Geoff Wilson is soliciting a wide range of 2,500 to 5,000-word articles for the online magazine on various urban agriculture topics; Book and report reviews; Consultancy services; new products and services; and coming events.
Information: Geoff Wilson, e-mail: fawmpl@powerup.com.au,website: www.urbanag.info; Tel: 07 3349 1422; Mobile: 0417 622 779; Fax: 07 3343 8287.

GAZA URBAN AGRICULTURE COMMITTEE (GUAC)

GUAC was created by the Palestinian Agricultural Relief Committees (PARC) in Gaza and after the organisation of a regional workshop in December 1998 on 'The Future of Urban Agriculture in Gaza Strip'. Actual members of the committee are: PARC, Palestinian Hydrology Group Ministry of Agriculture, Gaza Municipality, Khan-Yunis Municipality, the Palestinian Farmers' Union and Al-Azhar University-Gaza. GUAC conducts quarterly meetings which are also attended by other potential local partners like universities. The committee puts on one yearly plan of action, which includes: The improvement of the availability and efficiency of use of water resources for urban agriculture; **The promotion of the optimal use of available spaces for urban agriculture;** To enhance citizens' and urban farmers' awareness and knowledge of sustainable & organic urban agriculture; The establishment of extension and support services for urban agriculture; and Local institutional capacity development.
More information: GUAC, Gaza, Palestine; Tel:08 2805041; 08 2867178; Fax: 08 2805039; e-mail:haninahmed@hotmail.com.

NEW RUAF PARTNERS

The Resource Centre for Urban Agriculture and Forestry (RUAF) has extended its collaborative network to include the Middle East Region and China. For **China**, the regional partner is the Institute of Geographical Sciences and Natural Resource Research (IGSNRR) of the Chinese Academy of Sciences, in Beijing. The current IGSNRR was established just three years ago by combining two former institutes of the Chinese Academy of Sciences. One is the Institute of Geography established as early as 1940 and the other is the Commission of Integrated Survey of Natural Resources established in 1956. The new institute is noted for its academic capability in comprehensive researches in spatial-related economic analysis and natural resources studies in China. It consists of five centres, i.e. the Centre for Regional Studies and Natural Resources Economics, the Centre for Land-based Ecosphere and Environmental Studies, the Branch of Geo-information Sciences, the Branch of Ecosystem Research and Network, and the Centre for Agricultural Policy Researches. Regional, Urban and Rural studies, including Urban Agriculture, particularly in Tourism Agriculture, are one of the competitive research fields in the institute, which have got national-wide recognition. At present, there are 220 academic staffs and more than 100 supporting staffs in the institute with over 100 research projects from various funding sources. The institute is also famous for its post-graduate education. The IGSNRR is currently working on the translation of No.1 of the *UA-Magazine* in Chinese.
The contact person is Dr. Jianming Cai, e-mail: caijm@igsnrr.ac.cn.

For the Middle and Near East Region, the regional partner is the Centre for Environment and Development in the Arab Region and Europe (CEDARE) based in Cairo, Egypt. CEDARE was established in 1992 on the basis of commitment by the main sponsors, namely the Government of Egypt, the Arab Fund for Economic and Social Development (AFESD) and the United Nations Development Programme (UNDP). CEDARE is working in the Arab Countries and the countries around the Mediterranean. One of CEDARE's strategic missions is to promote collaboration and partnerships among Arab countries and between them and other developing and developed countries. The Operational Programmes and Units are: Land and Water Management, Marine and Coastal Management, Urban and Human Settlement, Socio-economics of Sustainable Development; Environmental Information and Documentation; CEDARE is currently working on the translation of No.1 of the *Urban Agriculture Magazine* into Arabic.
The contact person is Prof. Dr Ismail El Bagouri; email: ibagouri@cedare.org.eg; website: www.cedare.org.