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# URBAN AND PERI - URBAN AGRICULTURE

A briefing guide for the successful implementation  
of Urban and Peri-urban Agriculture in Developing  
Countries and Countries of Transition

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## 1. Edition

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Handbook Series

Volume III

SPECIAL  
PROGRAMME  
FOR FOOD  
SECURITY

Implementation of the  
SPFS within the  
framework of the  
follow-up to the  
World Food Summit

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, July 2001

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## *Introduction and Acknowledgements*

This is the first edition of a briefing guide for the successful implementation of urban and peri-urban agriculture (UPA) in developing countries and countries of transition, in particular Low-Income Food-Deficit Countries (LIFDC). It is primarily designed to assist in implementing UPA components of FAO's Special Programme for Food Security (SPFS), and it provides useful information to policy makers, and planners, practitioners, and extensionists.

The guide fills a gap in the field guidelines series of the SPFS and is thought to be a living document which is expected to be updated and revised on a regular basis.

The document was compiled by Dr. Axel W. Drescher, Consultant, and it is available on the FAO Intranet: <http://internal.fao.org> and on CD Rom (in pdf format) on request. It is complementary to the FAO Publication "Food for the Cities - Food supply and distribution policies to reduce urban food insecurity", Food into Cities Collection, DT/43-00E, prepared by Olivio Argenti of the FAO Marketing and Rural Finance Service (AGSM).

The guide has been prepared with valuable contributions from members of the FAO Interdepartmental Working Group on Food for the Cities (IDWG – FFC), in particular the Informal Working Group on Urban and Peri-urban Agriculture.

Special thanks go to the following FAO staff members for their valuable contributions to this guide: Olivio Argenti and Anthon Slangen, Marketing and Rural Finance Service (AGSM); Emmanuelle Guerne Bleich, Animal Production Service (AGAP); Wilfried Baudoin, Crop and Grassland Service (AGPC); Florence Egal, Nutrition Programmes Service (ESNP); Renata Clarke, Food Quality and Standards Service (ESNS); Michelle Gauthier, Forest Conservation, Research and Education Service, (FORC), Neeltje Kielen, Water Resources, Development and Management Service (AGLW); Manuel Martinez, Inland Water Resources and Aquaculture Service (FIRI); Ester Zurberti, Extension, Education and Communication Service (SDRE). Special thanks are also due to Yeb Hiemstra, Coordination and Management Service (TCOS) for coordinating the inputs of the various FAO technical services.

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*to*  
**EXTENSIONISTS**  
*and*  
**URBAN PLANNERS**



On October 12<sup>th</sup>, 1999 the international community observed the Day of the Six Billion. The population of our planet was only 2.5 billion in 1950 and is expected to be 8.9 billion in 2050. By the year 2005, more than half the world's population will be living in cities. Local communities as well as the governments have always been concerned with feeding the growing population. In 1995 world food per caput supplies were 18% greater than in 1965 while the population growth was 70%.

The worldwide urban population is expected to double in 30 years, but the number of urban poor is expected to increase at a greater rate. The World Bank says that, due to high rates of urbanization, the majority of the poor live in urban areas in many countries. As of April 2001, 82 nations were defined as low-income food deficit countries (LIFDCs): 42 in Africa, 24 in Asia, 7 in Latin America and the Caribbean, 6 in Oceania and 3 in Europe. These countries are home to the vast majority of the world's 800 million chronically undernourished people.

The findings of national censuses, household surveys and research projects suggest that **up to two-thirds of urban and peri-urban households in developing countries are involved in agriculture.**

**Within the next 20 years, more poor and undernourished people in developing countries will live in cities than in the countryside.**



Much of the food produced is for own consumption, with occasional surpluses sold to local markets. In Africa, poor urban Kenyan households have to spend 40 - 50% of their income on food and cooking fuel alone. More recently, as a result of the economic slow-down particularly in East Asia, the urban employment opportunities have shrunk. The situation is becoming particularly critical in Indonesia, Thailand and the Philippines. Urban food production is in many cases a response of urban poor to:

- inadequate, unreliable and irregular access to food supplies, due to either a lack of availability or a lack of purchasing power
- inadequate access to formal employment opportunities, due to national economies in crisis.

Specific traits of the horticulture sector are: rapid and high return; and high labour inputs.

These countries could, therefore, seize their comparative advantage of cheap labour in order to conquer selected market niches for local consumption or export. Furthermore, horticulture can usefully be integrated in the global urban waste management strategy for the recycling of organic waste and by-products (compost making) and use of non conventional water.

Fruit tree crops from agroforestry systems or estate plantations are critical to maintain on a large scale the sustainability of lands and water resource in fragile ecosystems. Domesticated and wild fruit and multipurpose tree plantations (e.g. date palms, citrus, merula) in and around cities provide fruits, fuelwood, flowers and other products. Green belt plantations surrounding cities can play a vital role in protecting gardens and infrastructure against winds and sand encroachment. They improved the micro climate for annual crops, and are indispensable in mountainous areas. In one Pacific islands home-gardens, many types of tree, shrub, climbing, ground and root crops are cultivated and play a vital role in feeding and maintaining the nutritional status of urban dwellers.

Commercial peri-urban production of livestock is an extremely fast-growing sector, representing 34% of total meat production and 70% of egg production worldwide. In most developing countries keeping a few household poultry is a common practice. In and around cities, urban farmers grow horticulture crops on small plots as a part time activity or become professional growers dedicated to an intensive market gardening.

In Mexico City pigs and poultry are kept within the backyards of family homes. Producers keep an average of 3 pigs and 26 birds per household, but there are some individuals who manage up to 60 pigs, all kept within the family. Their nutrition is based on the use of food wastes available from the city including kitchen wastes, stale bread and tortilla, left-over tortilla dough, chicken guts, and fruit and vegetable wastes from the

markets, amounting to 4000 tonnes per day.

One study of urban agriculture in Nairobi showed the land used for horticulture was 32% private residential land, 29% roadside land, 16% along riverbanks, and 16% in other publicly owned areas. 650 ha of the urban area of Dar es Salaam, are used for vegetable production on open spaces. This is an important source of income for over 4000 farmers. Worldwide artisanal aquaculture production is, for example dominated by Low-Income Food Deficit countries (LIFDCs). Artisanal fishers increase family food security not only through their earnings, but also with the discards they put on the family table. It is our all responsibility to make sure that poverty in cities is reduced and food security for all is guaranteed. This booklet will help to gain ideas for practical solutions.



**WATERING VEGETABLES IN ASIA**  
(Photo FAO)

# THE POLITICAL CONTEXT OF URBAN AND PERI-URBAN AGRICULTURE (UPA)



## COAG 15th session



## World Food Summit

World leaders assembled in Rome in November 1996 for the World Food Summit aimed at renewing global commitment to the fight against hunger. The summit was an FAO response to widespread under-nutrition and growing concern about the capacity of agriculture to meet future food needs.



A ZAMBIAN WOMEN SEEKING FOR FOOD ON A WASTE DISPOSAL SITE

Photo: Drescher

At its fifteenth Session in January 1999, the Committee on Agriculture (CL 116/8, CL 116/9 & CL 116/10) recommended the development of Organization-wide, and coordinated cross-sectoral programme on Urban and Peri-Urban Agriculture (UPA).

This endorsement concerning UPA requires that FAO, together with its partners:

- ≠ Provide guidance and assistance to member countries, in active cooperation with existing international networks by focusing its UPA activities on areas of its comparative advantage and interacting in a complementary manner with other UN organizations, local grassroots organizations, NGOs, and other organizations. These activities should lead to an improved understanding of the benefits and risks inherent in urban food security and provide a knowledge base on the issues of Urban and Peri-Urban Agriculture.

### Incorporation of UPA into existing FAO Programmes:

- ≠ Testing methodologies for UPA through new and existing programmes including crop intensification and diversification opportunities.
- ≠ Providing specialized guidance on food safety to urban and peri-urban farmers, food handlers and food processors.
- ≠ Offering technical back-stopping for existing and on-going local project development in urban and peri-urban agriculture.
- ≠ Identifying appropriate policy interventions for maximizing contributions of food supplies for at-risk groups and poor households.



## Roundtable of Top Local Government Officials, New York, 1997

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### Challenges and Benefits of Urban Agriculture

- need for water-conserving farming systems, cost recovery from water-consuming producers, treatment of wastewater for vegetable irrigation;
  - need for adequate agricultural technical supervision/extension to producers (site-appropriate crop selection, integrated pest management, efficient production technologies, affordable value-adding);
- need to promote and finance greater linkages between production, processing (agro-industry) and marketing for more self-reliant urban food systems, more local employment and revenues;
- need for greater decentralization of agricultural policy from central to municipal governments, for support to locally relevant urban food production and sustainable urban food systems.

URBAN AGRICULTURE FOR FOOD SECURITY,  
JOBS AND WASTE RECOVERY:  
ROUNDTABLE OF TOP LOCAL GOVERNMENT  
OFFICIALS

UN OFFICE BUILDING, ONE UN PLAZA  
29 JULY 1997

SECOND INTERNATIONAL COLLOQUIUM OF  
MAYORS ON GOVERNANCE

FOR SUSTAINABLE GROWTH AND EQUITY  
(UNDP),

UNITED NATIONS, NEW YORK CITY, 28-30 JULY  
1997



## Declaration of Quito, 2000

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### *We are urging*

Local governments to promote Urban Agriculture in their cities, develop tax incentives and other policies, and promote the collection of information on Urban Agriculture activities in their territorial planning processes.

State and national governments to include Urban Agriculture in their programs to alleviate poverty, food safety, promotion of local development and environmental and health improvement.

### *We are encouraging*

Cities to recognize the significance of the contribution of Urban Agriculture to social development approaches, generation of jobs and income, self-esteem, environmental improvement and particularly food safety, and to add them to their key development goals in a transparent and concerted way.

### *We reaffirm*

Our commitment to improve urban management through the promotion of Urban Agriculture experiences in our cities, ....as to enhance food security, address urban poverty, improve urban environment and health management, and develop more participatory and less excluding governance processes, as well as to protect urban biodiversity

QUITO, ECUADOR, ON APRIL 16-20, 2000,

ON THE OCCASION OF THE "URBAN AGRICULTURE IN 21ST CENTURY CITIES" WORKSHOP, SIGNED BY 27 LATIN-AMERICAN CITIES



## The Special Programme for Food Security (SPFS)

The Special Programme for Food Security (SPFS) is a multidisciplinary programme that combines expertise and experience from a wide range of fields to promote an integrated and participative approach to food security. The programme was launched by FAO in 1994 after its unanimous approval by the FAO Council at its 106th session. Moreover, its concept was endorsed by world leaders at the World Food Summit in 1996.

### Objectives of the SPFS

The main objective of the SPFS is to help the developing countries, in particular the Low-Income Food-Deficit Countries (LIFDCs), to improve food security both at household and at national levels through rapid increases in food production and productivity, by reducing year-to-year variability in food production on an economically and environmentally sustainable basis and by improving people's access to food.

The underlying assumption is that in most of the 82 LIFDCs viable and sustainable means of increasing food availability exist but are not realized because of a range of constraints that prevent farmers from responding to needs and opportunities. By working with farmers and other stakeholders to identify and resolve such

constraints - whether they are of a technical, economic, social, institutional or policy nature - and to demonstrate on the field practical ways of increasing production, the SPFS should open the way for improved productivity and broader food access, both in rural and urban areas. The SPFS includes in its design an element of urban and peri-urban agriculture, aimed at improving access to food of people living in and around cities.



### Strategies of the SPFS

SPFS implementation takes place in two phases. **Phase I** is a micro-economic phase consisting of four major components: water control through small systems of water collection, irrigation and drainage, intensification of crop production systems, diversification of production systems into small animal production, artisanal fisheries and aquaculture and analysis and resolution of socio-economic constraints to food security.

The scope of the Programme's **Phase II** is determined by the outcome of Phase I and by the need for integration with national strategies and programmes for agricultural development, sustainable use of natural resources and improved food security.

The aim is to build on the achievements of Phase I to create the macro-economic and financial environment for large-scale replication of micro-approaches that have proved successful.

Phase II, i.e. the macro-economic phase, has three dimensions: an agricultural sector policy reform to overcome socio-economic constraints, an agricultural investment programme to address infrastructure and the preparation of feasibility studies of bankable projects designed to ensure bilateral and multilateral financing.

Core features of the SPFS strategy are national ownership with the participation of farmers and other stakeholders at all stages of the Programme's conception and implementation, priority given to small farmers, environmental awareness, integrated and multidisciplinary approach, emphasis on modernization of low-cost simple technologies and social equity (gender and role of vulnerable groups).



**More Information on the SPFS is available on: <http://www.fao.org/spfs/>**

### **Urban and Peri-urban agriculture and the Special Programme for Food Security**

The Director-General of FAO underlined the importance of urban and peri-urban agriculture (UPA) in food security among urban populations. The Director-General, therefore, requested that the Phase I of the SPFS should include at least 5 sites of UPA around big cities out of 30 sites to be covered by this phase.

**It is therefore urgent that governmental and municipal authorities make the necessary arrangements and promulgate the required regulations for the sustainable development of UPA, which predominantly related to horticulture production but also includes small livestock and aquaculture. Public authorities are expected to take their responsibilities in securing the required resources essentially the land and small plots (horticulture or green zones) within and around cities, as well as sufficient water of good quality. From a technical point of view, it is urgent that improved crop management practices, technical packages and training provided under the SPFS to avoid the over- and mis-use of pesticides and other hazardous practices with the aim to supplying the high quality and "safe" produce to serve the combined interest of the producer, the environment and the consumer.**

Andre Regnier  
(FAO – ADG, Nov. 1999)



# URBAN AND PERI-URBAN AGRICULTURE

## DEFINITIONS AND SCOPE

### Definitions

Urban and peri-urban agriculture (UPA) occurs within and surrounding the boundaries of cities throughout the world and includes products from crop and livestock agriculture, fisheries and forestry in the urban and peri-urban area. It also includes non-wood forest products, as well as ecological services provided by agriculture, fisheries and forestry. Often multiple farming and gardening systems exist in and near a single city.

(FAO 1999)



Urban agriculture has been defined as '...an industry that produces, processes and markets food and fuel, largely in response to the daily demand of consumers within a town, city or metropolis, on land and water dispersed throughout the urban and peri-urban area, applying intensive production methods, using and reusing natural resources and urban wastes, to yield a diversity of crops and livestock.'

(UNDP 1996)

More information on definitions and scope is available at:  
[http://www.idrc.ca/cfp/rep08\\_e.html](http://www.idrc.ca/cfp/rep08_e.html)



MEGA CITIES DEVELOPMENT (Source FAO)



HORTICULTURE (Photo FAO)



MAIN PURPOSE OF UPA IS FOOD PRODUCTION FOR THE POOR (Photo FAO)

## The Scope

UPA comprises a set of different possible activities. The scope of urban and peri-urban food production varies from continent to continent. This variation derives from many factors, e.g., the economic status of the country and the households (which determine their needs), the household itself (determined by its size, labour force, assets etc.), Cultural aspects (which partly determine the kind of crops grown), the infrastructure and availability of fossil energy and inputs (which determine transportation capacities, availability of seeds and fertilisers), climate, soils and water.

The main components of UPA are:

- è · Urban and peri-urban horticulture and crop production
- è · Urban and peri-urban animal husbandry
- è · Urban and peri-urban forestry
- è · Urban and peri-urban aquaculture



RABBIT RAISING (Photo FAO)



URBAN HORTICULTURE IN JAKARTA  
(Photo CIRAD)



AQUACULTURE SYSTEM (Photo FAO)



POULTRY RAISING (Photo FAO)





# URBAN AGRICULTURE

## Production sites

Urban agriculture is practised on small to medium size areas within the city for growing annual and tree crops, raising small livestock and fish for home-consumption or sale.

Urban agriculture can be found:

- š on vacant plots
- š in home gardens
- š on verges
- š in containers
- š on balconies
- š on roof tops
- š in fishponds
- š in school gardens
- š on open spaces
- š on road strips
- š along Railways
- š below power lines
- š on river banks
- š in rivers
- š on communal lands for community-based gardening



MICRO GARDEN IN LUSAKA (Photo Drescher)



OPEN SPACE CULTIVATION IN JAKARTA (Photo CIRAD)



PRIVATE HOME GARDENS IN LUSAKA (Photos Drescher)



CULTIVATION ALONG THE RAILWAY IN DAR ES SALAAM (Photo Dongus)



**HOUSEHOLD GARDENERS IN EASTERN EUROPE** (Photo FAO)

Community-based and individual food production in cities meets several needs of the urban population.

Because of the multifaceted nature of the urban food insecurity there is need of an interdisciplinary, integrated approach to the urban sector.

**Any programme has to consider, at least in the earlier stage of programme planning, all kinds of urban and peri-urban production systems and the complex urban-rural interactions.**

We need to distinguish between the production of perishable, nutrient-rich and essentially commercial foods, such as vegetables, fruits, eggs, milk and poultry, on the one hand, and of staple foods and other subsistence foods, on the other.

## Needs Met by Urban Food Production Activities



### THEY:

- £ aim food production, income generation and recreational opportunities;
- £ contribute to the prevention of micronutrient deficiencies
- £ can enrich the urban environment;
- £ improve access to consumer markets;
- £ imply less need for packaging, storage and transportation of food;
- £ create potential agricultural jobs and incomes;
- £ provide non-market access to food for poor consumers;
- £ increase availability of fresh, perishable food;
- £ improve proximity to services, including waste treatment facilities;
- £ create opportunities for waste recycling and re-use possibilities.
- £ contribute to preserve and improve biological diversity by integrating it in the ecosystem



**THE USE OF RAILWAY LINES FOR CROP PRODUCTION IN SOUTH AFRICA**  
(Photo Drescher)

## PERI -URBAN AGRICULTURE

Peri-urban agriculture happens on farm units close to town that operate intensive semi- or fully commercial farms to grow vegetables and other horticulture, raise chickens and other livestock, and produce milk and eggs. Peri-urban agriculture embraces other activities too, such as fish farming. Creation of fish ponds is increasing in Malawi and the Daloa region of Côte d'Ivoire. Grilled tilapia from these ponds is on the menu of many street restaurants.

Based on research results, practitioners and researchers have expressed the need for a clear differentiation between urban and peri-urban agriculture. This distinction is not to suggest two different programmes, but to recommend differences in the approach towards the two spaces.

Peri-urban agriculture has been supported for a long time through development projects and technical assistance (e.g. in the 1970s and 1980s through OECD). The peri-urban areas of most cities are explicit sites for horticulture. The recent interest in UPA is a consequence of rapidly growing cities in the South and the related food insecurity in these cities.



### PERI -URBAN PRODUCTION ON TERMITE HILLS (Photo Drescher)

Cultivation of Swiss Chard on fertile soils of Termite hills near Lusaka increases yields and reduces the need for fertilizer inputs.



### AQUACULTURE FISH PONDS

A model fish farm in Laos. Shelter above water is for chicken farming; excrements drop into the pond and constitute an input to the integrated system. (Photo FAO)

**A PERI -URBAN PROJECT DESCRIPTION IS AVAILABLE AT:**

<http://www.avrdc.org.tw/periurban.html>





## BOX 1 URBAN AND PERI-URBAN

### Differences between "urban" and "peri-urban"

#### Characteristics of "urban" and "urban agriculture"

attitudes differ between urban and peri-urban dwellers

different kind of people, often women

different activities, often small scale subsistence

concept of "urban" varies a lot cross-nationally

UA is part time job

UA technology is different from PUA due to smaller plot sizes and different motivation for agriculture

knowledge of urban farmers is different urbanised

more infrastructure/construction

more services (banks, schools, medical centres etc.)

different land use than in peri-urban areas, smaller areas cultivated, more subsistence production

lower availability of natural resources

differences in policies/incentives/disincentives, institutional responsibilities (urban)

easy access to markets

poor air quality

high cost of labour and land

primarily subsistence production

management strategies different from PUA, mostly small scale agriculture

small-scale, scattered and low-value crops produced in cities

practised by poor urban dwellers for subsistence

UA can never become UPA again, but expand when zones of "urban blight" evolve

#### Characteristics of "peri-urban" and "peri-urban agriculture"

peri-urban production is economically dependent on the city

lower population density than urban

more land/space available

PU area has more natural resources

PUA is a full time job

PUA technology is different from UA, due to larger plot sizes and more commercialised agriculture

knowledge of PU farmers is different

land under threat of urbanisation

less infrastructure/construction

fewer services (banks, schools, medical centres, etc.)

different land use than in urban areas larger areas cultivated

higher availability of natural resources

differences in policies/incentives/disincentives

institutional responsibilities (urban/rural)

less access to markets

better air quality

lower cost of labour and land

Primarily market oriented production

management strategies different from UA, medium to large scale agriculture

Intensive, market-oriented, high value crops

practised by groups and individuals with ready access to capital markets

UPA can become UA with accelerating urbanisation



## GENDER ASPECTS OF UPA

Women play an important role in household food supply: through their productive labour; through their decision-making about production, consumption and division of food; and through the income they generate, which is often used to buy food. Various studies have shown that women's income has a greater positive impact on the health and nutritional status of the children than does men's income. Women (especially widows) and elderly are powerless in many urban societies. Any policy intervention therefore should take the gender and ageing issue into consideration. Women tend to dominate urban cultivation because they are marginalized in other forms of employment in the formal sector of the urban economy. In some cases in Southern Africa urban agriculture is even synonymous with "farming by women", indicating that this is a very typical female work.



COMMUNITY GARDENING BY  
WOMEN FARMERS (Photo FAO)

### Side Step

With respect to policy recommendations there is major concern with the gender dimension. Urban agriculture in many cities is an important income generating "working niche" for women farmers. Women, generally excluded from the formal employment market are searching for income possibilities that align with their other needs. Zambian women have expressed lack of means to earn income as a major feature of poverty.

Supporting UA through policy decisions might lead to a trend towards intensification and commercialisation of this activity - thus making it more of a men's domain and diminishing women's job opportunities. Policy recommendations should therefore also consider strengthening women's access to the formal labour market. Any policy recommendation with respect to standardisation and quality of products should take into consideration the individual character of family-based food production. Traditionally extension officers are not trained for intervention in this field of activity. Misuse and abuse of power must be prevented and therefore the urban issue requires training for extension staff.

**Further Reading: More information on the role of gender is available at:**

**[http://www.idrc.ca/cfp/rep21\\_e.html](http://www.idrc.ca/cfp/rep21_e.html): NGO Gender Capacity in Urban Agriculture: Case Studies from Harare (Zimbabwe), Kampala (Uganda) and Accra (Ghana)**

**A RESOURCE GUIDE CAN BE FOUND AT: <http://www.idrc.ca/cfp/gender.html>**

# URBAN AND PERI-URBAN AGRICULTURE

## THE MODULES

### URBAN AND PERI - URBAN HORTICULTURE

Horticulture production development in urban and peri-urban areas is proposed as a means to partially meet the job and food requirements of the increasing urban population. In view of its potential high return rate and scope for intensification, horticulture (mainly vegetable and ornamental plant production under irrigation, but also fruits, tubers and roots, and mushrooms) can be an attractive opportunity in meeting the above challenge. Horticulture species, as opposed to other food crops, have a tremendous yield potential and can provide up to 50 kg of fresh produce per square meter per year, depending on the technology applied. As compared to other agricultural activities horticulture makes efficient use of the scarcely available land and water resources. Locating their production close to the consumption centres will help to contain the requirements for special packaging and storage facilities and reduce the post-harvest losses, which commonly reach 30%.

#### TYPES OF URBAN AND PERI - URBAN HORTICULTURE AND APPROPRIATE TECHNOLOGIES

In urban and peri-urban areas three broad categories of horticultural producers can be distinguished. The

division is mainly related to the growers excess to land and water resources which largely determines the type of activities that can be developed.



**Stakeholders: Families that have no access to land normally living in densely populated areas**

½' Urban micro-gardens and mushroom production as well as high value exotic ornamentals, condiments and aromatics

A simple and low-cost technology is proposed for growing healthy and safe vegetables on roof tops, terraces or patios without requirement for soil i.e. micro-gardens or hydroponics. This system is ideally suited for uptake by women's groups or unemployed labour force who would not only be able to produce for their own needs but could also produce small surpluses for sale, providing them with minimum cash. Some specialised production could be specifically targeted for sale i.e. condiments and aromatic plants which could be locally processed.

Urban micro-gardens are a simple low-cost technology adapted to the high density areas of urban suburbs. They can be established almost everywhere – in backyards, on flat roof-tops, balconies and even hanging on walls. Micro-gardens are best suitable for the urban landless. The technology allows the

land-less households to produce a broad range of vegetables for family consumption and sale to the neighbourhood. The system is based on growing crops on substrates or floating on water.

Of a total cost (fix + variable) of approx. 4.6 US \$/sqm, fertilizers are only 0.63 US \$/sqm. In many countries the availability of mineral fertilizers is a limiting factor. In this respect research is needed for the use of alternative sources including organic nutrient solutions obtained from the fermentation of organic waste material. A low cost, simple and proved formula is available from the self-teaching course prepared by FAO in 1993 on simplified hydroponics that is at:

<http://www.rlc.fao.org/prior/segalim/prodalim/prodveg/10046.pdf>

The micro-garden system is environmentally friendly since it not only uses recycled materials, but also for growing in a “closed system” with a very high water use efficiency ratio.

The cost-benefit analysis shows that these micro-gardens when successfully implemented, can provide for 1 to 3 US\$ a day as an “opportunity revenue” from a 10 sqm, which is often competitive as compared with the casual labour wage, the women could obtain by working outside the household. A variation on the micro-garden is the hydroponic (see Box).



**A SOLAR DRIVEN HYDROPONIC IN SOUTH AFRICA.** The nutrients are pumped from the bottom to the top of the system with the help of solar energy. (Photo Drescher)

***Stakeholders: Families that have access to small-size plots normally living in populated urban areas***

è Highly intensive cultivation systems under localised irrigation methods and small-scale nurseries.



**HYDROPONIC MICRO-GARDEN SYSTEM** (Photo: C.Marulanda and J.Izquierdo, 1991)





**"ORGANOPONICS" IN CUBA** (Photo Drescher)

In many areas in the world horticultural crop production relies on the use of irrigation to reduce the risks associated with rainfall variability and to optimise input use. Though water is scarce in many urban centres and water systems are not designed for the increasing population. As water supply for agricultural uses in cities is not planned for in most cities alternative water sources of reliable quantity and quality need to be sought. For cultivation in urban centres these sources might include groundwater, collected rainwater, protected springs and wells, or sometimes extension of the municipal water supply network.

**Irrigation is a key tool for agricultural intensification.**

**Although only 16 percent of the world's fields are irrigated, they yield 36 percent of global harvests. In developing countries, irrigation increases yields of most crops by 100 to 400 percent. Despite this, some of the world's most needy farmers are still unable to water their land effectively.**

As part of the Irrigation component of the Special Programme for Food Security, treadle pumps were installed, tested and demonstrated in various parts of Zambia. The Zambian farmers, who usually draw water by bucket from ponds and shallow wells for their vegetable plots, were enthusiastic about the ease with which the treadle pumps were installed and the volume of water pumped.



**TREADLE PUMP IN ZAMBIA - A SOLUTION FOR THE URBAN SECTOR AS WELL** (Source FAO

<http://www.fao.org/news/1997/970409-e.htm>)

To further minimise competition between water users and to prevent contamination of down stream water sources efficient irrigation methods such as small scale localised irrigation methods should be promoted. Depending on the financial and economic situation of the producers irrigation methods promoted might be based entirely on local materials and workmanship, imported materials but local fabrication or imported components e.g. low pressure drip



irrigation. For more information on irrigation methods see Box 4 on page 61.

***Stakeholders: Families that can be integrated in organised growers' schemes in open urban spaces and peri-urban areas***

è Establishment and organization of small-scale allotment schemes.

These schemes would aim at the development of intensive commercial horticulture for year round production of high quality vegetables and ornamentals as well as intensive fruit tree orchards for local consumption or export. Modalities for contract growing or joint ventures would be explored. Marketing potential and peri-urban versus countryside comparative advantage for horticultural production would need to be carefully analysed as a pre-requisite to programme's formulation.

***Participatory Training and Extension could be used as the preferred development approach and training methodology***

For each of these groups projects will aim at introducing and demonstrating adapted technologies including cost-efficient water supply which includes reuse of treated wastewater, low-cost and efficient irrigation, manure production and simple and low-cost shelter structures which will protect the crop against the adverse effect of high rainfall. Concurrently, farmers will be provided with improved vegetable and fruit varieties highly adapted to local climatic conditions as well as high

quality mycelium strains. They will also be trained in cropping system management, the adoption of Integrated Plant Production and Protection Management (IPP), in order to avoid the excessive use or misuse of pesticides and fertilisers. To be successful farmers will need to be organised in farmers' groups or growers associations. The main challenge from a water point of view is to promote (peri) urban horticulture in such a way that it does not compete with other urban water needs, is environmental friendly and does not pose risks to human health. At this level it is often proposed to use treated wastewater to attain increased food security and recycle two valuable resources, i.e. water and nutrients. Decentralised community-based treatment facilities are promoted as a solution for developing countries. Regulations and health guidelines for reuse of treated wastewater for food production are the major issues when promoting reuse of treated wastewater for irrigation.

The primary objective of wastewater irrigation reuse projects should be to minimise or eliminate potential health and environment risks. To ensure this monitoring and legal authorisation to enforce compliance with regulations and guidelines is required. To attain this an adequate legal, institutional and administrative framework is required. In addition a well functioning community-based organisation structure is a prerequisite. Training and education of local communities is of critical importance as well as.



Unless projects for food production have a specific objective to develop a scheme for recycling of wastewater with the primary aim to minimise or eliminate potential environmental and health risks by addressing technological, social, economical, legal and institutional aspects, reuse of wastewater in (peri) urban food production should not be promoted. Other reliable sources of water of sufficient quantity and quality, which do not interfere with other urban needs, should be considered first (See Annex 3 for an example on Integrated wetland systems).

*Yam can be grown anywhere:*

*...even downtown, on paved roofs, terraces, balconies and why not? in the living room. In Cameroon, for example, a clever do-it-yourselfer senior citizen of some sixty odd years has developed an original method of growing a white yam variety. It has the decided advantage of being cheap and represents a good example of economic use of space in cities.*

*The yams are planted in plastic sacks or cases made from raffia bamboo. These are filled with a mixture of soil and compost, and a yam seedling is planted 10 cm deep.*

*The stalks are attached to stakes, and guided towards the roof, or to branches of nearby trees. They are protected from sun and rain by a straw sheet. When the yam tubercle starts to form, the downward head is removed, taking care not to damage the roots. This allows the tubercle to be sliced up into several new pieces. When ready to harvest, the yam is almost the same size as the sack or case (about 1 metre in length).*

*Source: SPORE no 76 - AUGUST 1996*



**SOPHISTICATED HYDROPONIC SYSTEM IN SOUTH AFRICA YIELDS LARGE AMOUNTS OF SWISS CHARD**

(Photo Drescher)

**Further Reading:** FAO (2001): Participatory Training and Extension in Farmers' Water Management.

<http://www.fao.org/ag/AGL/aglw/farmerwatertraining/>

## **PARTICIPATORY TRAINING AND EXTENSION IN FARMERS' WATER MANAGEMENT**

Farmers' Water Management (FWM) is the process in which individual farmers and farmers institutions set objectives for the management of their water resources; establish appropriate conditions, and identify, mobilize and use resources, so as to attain these objectives.

Participatory Training and Extension (PT&E) is a training and extension approach that is based on a participatory analysis of the constraints and opportunities and based on the outcome of this analysis the introduction of new and appropriate technologies. Group based extension and training activities that enhance farmers' capacities and skills, as well as capacity building of the staff involved in the extension activities go hand in hand.

PT&E is a tool to reach the goal of improved Farmers' Water Management involving and supporting farmers. In order to support farmers and increase their capacity in FWM they need training and support for the introduction of technologies.

The programme for Participatory Training and Extension in Farmers' Water Management (PT&E-FWM) was developed within the framework of the FAO- Special Programme for Food Security. It has been implemented and tested in several countries (Zambia, Nepal, Cambodia and Bangladesh). The PT&E-FWM programme incorporates the concept of the Farmer Field School (FFS) introduced under the Integrated Pest Management (IPM) programme. Although PT&E was not developed for peri-urban and urban irrigated horticulture it can be applied in this context. Still, micro garden development requires the installation of pilot modules and training.



**Development of intensified production of high value ornamental plants and quality vegetables targeting for the high income bracket population. Small scale nurseries could be launched in different neighbourhoods of the city in order to provide for vegetable seedlings, ornamental pot plants and flowers as well as fruit tree saplings for home and terrace gardening**

**Group based extension and training activities that enhance farmers' capacities and skills, as well as capacity building of the staff involved in the extension activities go hand in hand.**



# MICRO GARDENS



## Micro gardens

Beneficiaries: **landless poor people in urban areas**

Actors: **women & children**

Purpose: **daily availability of fresh vegetables for home consumption and neighbourhood marketing**



*before*



*after*

## Construction of a simple micro-garden:



**Materials and supplies needed:**



- 3 · Simple tools
- 3 · Substrate
- 3 · Wooden pallets
- 3 · Plastic sheet
- 3 · Seeds
- 3 · Irrigation water
- 3 · Nutrient solution



**Crops suitable for micro garden cultivation:** Lettuce, basil, tomato, beans, onion, potato, celery, pepper, carrot, cucumber, radish, cabbage, red beet, spinach, eggplant, strawberries, squash, etc.

**Criteria for a suitable location:** 1 to 10 square metres of free space, minimum of six hours of daily sunlight, clean water source.

**Possible container for cultivation:** Wooden crates lined on the inside with plastic, old tires, any plastic containers etc.

**Cultivation substrates according to availability:** Rice hull, sawdust, volcanic scoria, sand, gravel, coconut fibre, perlite, peat, peanut husks etc.

**Prepared by:** Horticultural Crops Group, Crop and Grassland Service,

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## BOX 2 SIMPLIFIED HYDROPONICS AND SUBSTRATE CULTURE

Under hydroponics, plants can be grown closer together than in the field, thereby increasing yields, and multiple cropping (the growing of several crops in the same tank) can be practiced. In addition to conserving space, hydroponics almost eliminates weed and pest problems.



SUBSTRATE CULTURES (Photo FAO)

Wood and plastic materials are provided so beginners can build their own growers. Each grower is one by two meters surface area. In these first projects the growers are placed on legs at least knee high. The small patio or backyard growers produce a crop of lettuce in 60 days. Each square meter of floating bed growers will produce one head of lettuce a day. So the three bed garden should provide a family with more than enough salad greens for a days needs.

Once the lettuce beds are established, some of the garden owners go on to increase their numbers of growing tables, increase daily production and provide more food for their families. A garden of 18 bed growers can produce about 4.5 kg of food a day in the

tropics. It is fresh food produced at a fraction of the cost of store purchased vegetables, and a start of a home based business.

The cost for hydroponic production differ form country to country. Being a space saving method, hydroponics do not need large areas.

Otherwise “unproductive” open space, like balconies or backyards do not require the payment of additional rent. The estimated costs for the establishment of hydroponics are at US\$ 1.50 fixed costs per sqm and US\$ 3.10 variable per sqm, which amounts to a total of US\$ 4.60. Compared to regular Irrigation, hydroponics are extremely cheap and water saving. If regular irrigation is set to 100, hydroponics require only 7 percent, compared to 30 percent for drip irrigation.



### Further Reading:

FAO (1990). Soilless culture for horticultural crop production. FAO Plant Production and Protection Paper 101.

How to teach Children in hydroponics is taken from:

<http://www.hydrogarden.com/children/comec/comic.htm> . The pages:

<http://www.rlc.fao.org/prior/segalim/prodalim/pr odveg/hidro.htm> ( Hidroponia

Escolar, in Spanish),

<http://www.hydrogarden.com> and

<http://www.carbon.org> provide many useful information on the subject.

How to make seeds for hydroponics is taken from:

Peggy Bradley ([www.hydrogarden.com](http://www.hydrogarden.com) and [www.carbon.org](http://www.carbon.org))

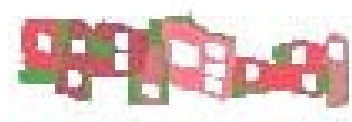


## URBAN AND PERI-URBAN SMALL ANIMAL PRODUCTION



### *LIVESTOCK SPECIES FOR URBAN CONDITIONS*

Livestock keeping in cities is common in many developing countries. Goats, sheep, cows, horses, camels, chickens, buffaloes, pigeons and many other types of animals can be found in cities around the world. Each of these animals has its specific advantages and disadvantages. Particularly small animals are adaptable to backyard conditions, they require little capital to start with, it is easy to sell them and they reproduce fast. Aquaculture represents an interesting diversification of agriculture at the periphery of cities. In Abidjan (Côte d'Ivoire), fish are fed rice bran and slaughterhouse residues or manure are used as fertilisers to produce feed. Tilapia culture in Southeast Asia is presently both spreading and intensifying. In Thailand, periurban enterprises use processing wastes and other inputs from cities.



**MILKING GOATS ARE IMPORTANT SUPPLIERS OF NUTRIENTS (PROTEIN) AND INCOME TO POOR FAMILIES IN MULTAN, PAKISTAN**  
(Photo FAO)



**"URBAN" COWS IN DAR ES SALAAM**  
(Photo Drescher)

## SOME FACTS

25% of the 4.5 million small ruminants in Ghana are raised by people living in and around cities and towns. National statistics quoted by van der Blik (1992) for the livestock population in Nairobi: 25,000 cattle, 30,00 small ruminants, 30,000 pigs, 8,500 rabbits and 350,000 poultry hint at the important contribution of the sector to protein needs of the urban population. A survey carried out by Gefu (1992) in Zaria, a Nigerian university town, revealed that 80% of respondents keep livestock, raising goats, poultry and sheep, primarily to meet immediate household needs, but also to supplement family income.

(CFP Series 24 , 1998)

In particular, the commercial peri-urban production of livestock is an extremely fast-growing sector, representing 34% of total meat production and nearly 70% of egg production worldwide. With it comes expansion in food processing activities in the peri-urban zones.

(FAO 1999)

### *Pig farming for urban conditions*

Pig farming in urban areas is common in many countries, except in places where Islam or Jewish religion is prominently present. Pig keeping adapts well to being a mostly family-type activity, where the role of women is very important, both in collecting household waste and in looking after the animals. Pig production implies a significant reuse of household waste as a feed, but the waste of commercial enterprises (bakery, market vegetable and fruit leftovers) and industrial (brewery, abattoir) activities is also quite welcome. Pig farming allows households to generate supplementary income in peri-urban squatter settlements (slums) in for instance Montevideo (Uruguay) and Port-au-Prince (Haiti). In these areas the activity is generally linked to the widespread practice of collecting,

sorting and selling of household waste to the local recycling industry.



**PIGS SCAVENGING ON A LANDFILL WITH GARBAGE IN VITORIA, THE CAPITAL OF ESPIRITU SANTU IN BRASIL** (courtesy Wubbo Boiten; 1987)

## CASE STUDY

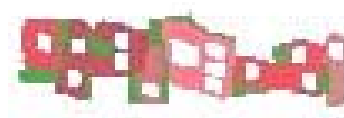
### *Trends and practices of pig husbandry in and around Port-au-Prince, Haiti<sup>1</sup>*

*Port-au-Prince is experiencing an enormous population growth and has almost reached 2.5 million inhabitants, mainly due to migration from rural areas. Surrounding towns and villages have been overgrown by the city resulting in a giant metropolis, which still has certain rural characteristics. Pigs and goats are widely raised and a common sight roaming around scavenging for feed. As such, in Haiti, pork is the most popular and expensive meat. The majority of the population can hardly afford fresh meat; they buy mostly cheap "fifth quarter" parts (ears, pettitoes) imported from the United States. Particularly, the elite who can afford the prices for meat of international quality standards in supermarkets constitute a niche market for fresh pork. Four types of pig producers can be distinguished:*

- ⌘ large producers (70- 90 sows);*
- ⌘ midsize producers (5 to 20 sows);*
- ⌘ small producers (1-2 sows) or fatten 1 to 5 pigs a year;*
- ⌘ "non-conventional" producers, who let the pigs scavenge in the streets and on garbage dumps. These "scavenging pigs" represent a major public health risk. Fortunately, Haitians usually "deep fry" pork before consumption preventing outbreaks of diseases like cisticercosis*



**SMALL SCALE PIG PRODUCTION IS A PROFITABLE ACTIVITY FOR MANY FEMALE HEADED HOUSEHOLDS IN PERI-URBAN AREAS IN HAITI (Photo FAO)**



## Chicken farming for urban conditions

Poultry production can be distinguished into traditional backyard poultry, semi-commercial, commercial and industrial poultry systems. Large poultry enterprises are found everywhere, but small scale poultry production is also widespread in urban areas. Poultry officially include chickens, ducks, turkeys etc., but this paragraph only refers to chickens.



**POPULAR IN VIETNAM AND OTHER SOUTHEAST ASIAN COUNTRIES, DUCKS ARE WELL ADAPTED TO HIGH RAINFALL, GROW TO A GREATER SIZE AND LAY MORE AND LARGER EGGS THAN MANY INDIGENOUS CHICKENS AND ARE LESS SUSCEPTIBLE TO DISEASES AND PARASITES** (courtesy M. van Dorp).

They are kept for many reasons, including gifts and ceremonial activities. A major purpose of chicken keeping is also to supplement the household revenues in terms of food and cash. With low daily wages the sale of only a few eggs can be a very substantial contribution to the family

income. However, urban households with relatively high incomes keep chickens, especially laying hens, because they think that eggs produced at home are of higher quality than those found at the market. The special liking that people take for village raised chickens (more taste, tougher meat) is expressed in a higher price for these animals. Specialised, large scale and market oriented chicken production is found in and around urban situations across the world where access to young chicks for broiler and egg production, inputs (feed) and markets is relatively easy.



**SCAVENGING CHICKENS PROVIDING AT ALMOST NO COST SOME EGGS, AT SPECIAL OCCASIONS SOME MEAT AND WHEN NEED ARISES, SOME CASH TO THEIR OWNERS IN SAHIWAL, PAKISTAN** (Photo FAO)



**The following section highlights two important modes of urban poultry:**

- traditional family poultry with scavenging chickens;
- backyard chicken production (small scale up to some 100 birds).

The two systems are fundamentally different from each other. Farmers with chickens in a scavenging system live with different economic and social conditions than those who keep backyard, often enclosed, animals. The latter produce mainly for the market and are therefore ready to spend cash on concentrates, disease prevention, housing. The former keep in the first place animals for home consumption or sale when need arises, and they do not invest because this way of chicken keeping is for them the most economic one. Unfortunately, the extension workers often mistakenly believe that, with education and some inputs, the scavenging system can be transformed fairly easily into a more intensive backyard system. This is a typical case where a so-called problem in (urban) livestock production can be overcome by re-orienting the extension workers: farmers are not necessarily stupid by adopting one mode of production or another, they behave according to rules based on tradition and economics.



**Family Poultry (FP) farmers organisations**

Organizing FP farmers is not an easy task. There are several reasons. Flock sizes are small and birds are maintained with minimal land, labour and capital inputs. That means that FP is generally considered by farmers as secondary occupation compared with other activities in agriculture, trade, etc. Nevertheless, it is essential to :

J · develop producers groups which will:

è · allow the group members to have easier access to inputs: feed supplementation, improved birds, drugs and vaccines, technical advice, etc., and

è · facilitate access to credit, training, transportation and marketing of poultry products

J · encourage educated people to initiate poultry farming as a secondary occupation, conducted at family level using medium-sized flocks, and

è · develop associated activities like market gardening which can utilize poultry manure and



SEMI -COMMERCIAL SYSTEM WITH BROILERS IN BATTERY CAGES MADE OF LOCAL MATERIAL (BAMBOO) WITH METAL TRAYS TO COLLECT DUNG WHICH IS USED ON GARDENS AS A FERTILISER IN BATU, INDONESIA (Photo, FAO)

### *Scavenging birds*

A flock of scavenging birds usually consists of some adult chickens, one cock and some pullets. In several places hybrid layers are also part of the same flock. Housing is absent or very rudimentary: often an improvised pen of old boxes upside down, baskets, etc. Grains, legumes, food wastes are given in provisional feeders or thrown on the soil. Water is supplied only in the dry season. Nests are made out of leaves or old clothes to keep costs low and scavenging chickens eat mostly household food leftovers, second quality grains and milling by products. Scavenging chickens need to be protected against predators during the night. In many cases the chickens spend the night in a tree. These trees can be covered by a metal guard. Farmers in Africa use often a small shed on poles, near the homestead. Dogs are sleeping nearby and in daytime even cocks are used to protect/warn the hens for pending danger of predators.

Low input (scavenging) poultry keeping is generally regarded as a women's activity. Husbands often become interested when more cash is involved. Especially government officers, who have access to cash and credit, take up the activity as a second source of income. Still, chicken production is highly preferred by women and can be an important tool to increase their income. Small informal groups to get women started on this activity have shown to be of significant impact.

Technical skills in poultry raising need to be considered at both farmer and extension levels. Training is essential for both farmers and extension officers in the following areas: disease control, housing and equipment, feeding, genetic improvement and marketing. A basic knowledge in specific features of poultry anatomy/physiology is also important to understand the basis of above topics. Housing and management could be improved through appropriate farmer training, preferably conducted on-farm. Local craftsmen could be trained to manufacture small equipment, like feeders, drinkers, etc.



## CASE-STUDY

### Home-based food production in urban Jamaica

#### Women's groups

The project aimed at strengthening women's groups through meetings held by RADA. In Bowerbank, the Bureau of Women's Affairs supported this part of the project. Training was given on team building and economic self-sufficiency, women's role in community development, developing positive self-esteem, and cooperation among urban and poor women. In both communities the women started to organize themselves into formal groups with regular meetings and a budget created by their own contributions.



CONSTRUCTION  
OF A CHICKEN  
COOP IN  
BOWERBANK (Photo  
A. Valstar)

### *Backyard system on pens*

This system refers to small scale activities with confined chickens that are undertaken by a family in their backyard. These activities demand care and the input of concentrates, whereas scavenging chickens balance their own feed intake and need less inputs. Young broiler chicks are usually bought at the age of one day, and fattened during a period of six to eight weeks. Governments and NGOs have been instrumental in getting such activities going. Especially help with vaccination schemes, input supply and marketing can serve very well to make them survive the first years. Feed can

consist of up to 70% of the total production costs. It is therefore important that feed is used efficiently. Good feeders that keep losses due to spoilage minimal are worth the investment. This activity is popular due to its quick returns in cash due to the short production cycle.

In the urban backyard an old building, or even a room is often used as a poultry shed. For confined chickens a good pen is required, of which easy waste disposal should be an important feature. A good example is a layer pen constructed at one meter height equipped with a floor of wire mesh or

wooden slats. Cleaning is normally done when the litter is absorbed with manure (around feeders and drinkers), and after every batch of animals. If cleaning is a hassle, it won't be done often enough, leading to health and environmental problems. Manure is a valuable fertiliser for gardens. Investments in easy manure collection are therefore also paid back by higher crop production and feed for livestock. Proper bedding (rice husks or fruit pulp rather than sawdust) can also make the dung even more palatable or used

to ensile the dung. The use of hormones or other medicines makes the dung less suitable for cows. Disease pressure in an enclosed environment is different than in open, "scavenging", systems. Especially coccidiosis occurs frequently when animals are confined, but timely application of coccidiostatica is effective. Worms, bronchial viral infections and bacterial diseases, like coli infections and cholera are frequent, but treatment and vaccinations can solve those problems.

**A number of factors and principles need to be taken into account in designing the most appropriate interventions.**



**These include:**

- €# local availability of feed resources (e.g. agro-industrial by-products, market and institutional food wastes, road-side forage, compounded feed, etc);
- €# the market demand for various animal products, including traditional and cultural preferences;
- €# market opportunities, including competitive advantage of locally produced animal products;
- €# availability of breeding stock; and
- €# the financial viability and credit worthiness of the proposed enterprises.

***Pre-requisites***

- J · an adequate understanding of the local markets (inputs and outputs), feed resources and the disease situation;
- J · a local willingness to participate in and contribute to a programme;
- J · an institution (government or NGO) capable of initiating and supervising the programme in the project areas;
- J · advisors/extension staff with the necessary skills and training; and
- J · functional credit institutions willing to co-operate with the programme.





**Possible range of typical activities:**

- è selection of potential target areas and communities based on national priorities, local resources and market opportunities;
- è identification, through consultation and Rapid Rural Appraisal, of the main potentials and constraints to production and, consequently, the most appropriate small animal species and the production practices for the areas;
- è preparation of appropriate and financially viable production packages;
- è training of technical staff, extensionists and selected farmers in the necessary skills required for successful backyard small animal production;
- è establishment of demonstrations units of the selected production systems in representative households and the development of out-reach programmes working closely with local credit institutions; and
- è a socio-economic evaluation of the impact of the small animal enterprise established with project assistance

**Further Reading:**

Losada et al (1997): Information on animal production in Mexico City:

<http://www.cityfarmer.org/mexico.html>

Rabbit Raising in Cities, facts form Hungary, Cuba and Nigeria:

<http://www.cityfarmer.org/rabbits.html>

More information is available on the bibliography on urban livestock at the Resource Centre for Urban Agriculture and Forestry (RUAF) in the Netherlands:

<http://www.ruaf.org/data/rptUrbanLivestock.PDF>

In view of lessons from the past rural poultry improvement programmes, a new approach should aim at increasing flock productivity instead of individual animal productivity. The potential of the village chicken as a provider of food and income should be exploited. A combined approach is suggested, which must be accompanied by improved extension services and farmer training on good husbandry practices, namely: housing, hygiene, feeding and health control: A.J. Kitalyi Village chicken production systems in developing countries: what does the future hold?

<http://www.fao.org/livestock/agap/war/warall/w6437t/w6437t07.htm>

In this edition of **New Agriculturist** some of the current challenges for improving scavenging poultry systems are highlighted, including species which have not yet fulfilled their potential. There is also a brief look at the potential for farming the world's largest bird - the ostrich.

<http://www.new-agri.co.uk/00-1/focuson.html>

Network for Smallholder Poultry Development, formerly the Danish Network for Poultry Production and Health in Developing Countries:

<http://www.poultry.kvl.dk/>

The First INFPD/FAO Electronic Conference on Family Poultry: The Scope and Effect of Family Poultry Research and Development (7 December 1998 - 5 March 1999):

<http://www.fao.org/ag/aga/agap/lpa/fampo1/fampo.htm>

XXI World's Poultry Congress, paper collection:

[http://www.wpc2000.org/content/prgrm\\_scientific.htm#proced](http://www.wpc2000.org/content/prgrm_scientific.htm#proced)

## URBAN AND PERI-URBAN FORESTRY



Innovative urban forestry practices promote the best use of trees within urban agriculture and other urban services. Urban forestry is not only street trees for beautification and parks for recreation. Many urban trees suitable for resource poor settlements can provide food, particularly fruits, but also edible leaves, shoots and even flowers. Managing trees and shrubs on the same land as agricultural crops or livestock in spatial arrangement or temporal sequence in poor neighbourhoods is common. Urban forestry programmes should facilitate this trend to plant fruit and multipurpose trees to increase the agricultural land sustainability. There are no reasons why different agroforestry techniques developed in rural area could not be adopted to the context of urban areas.

*Source: Kuchelmeister (1998)*

### Meeting resource-poor people's basic needs

Beyond their aesthetic and ecological value, trees can contribute to the satisfaction of energy requirements as well as the daily food requirements of urban dwellers, particularly in the case of the poorest elements of society.



### **Fuelwood supply**

People in many developing countries continue to depend on fuelwood and charcoal for their energy needs which are consequently satisfied by uncontrolled collection, often resulting in the extensive degradation of areas around urban settlements in developing countries. When "free" wood energy supplies are exhausted or are too difficult for people to tap into, fuelwood markets develop. Even this energy source is relatively expensive; studies report expenditures of 30 to 40 percent of total income by low-income groups to meet domestic energy requirements. Wood-based building materials - poles, branches and leaves for thatching are also in high demand in many urban areas. In addition to greenbelt plantations, the renewal of fruit-tree plantations and the maintenance of street trees and parks may be an interesting source of fuelwood material.

### ◆ **Food production**

Fruit-trees are often an important component of urban home gardens. In some places, trees are planted to help supplement fodder needs and even to provide raw materials for handicrafts. The role of agroforestry in improving productivity and diversifying production should be examined - it is a field that should become much more important in the future. Food producing trees are

not widely grown in public places, although Webb (Webb, cited in Carter, 1994) reports that in Beijing, persimmon and walnut trees are grown in parks, and in Singapore the Housing Authority has a policy of growing fruit trees in housing areas for the benefit of elderly people.

#### ◆ Home Gardens

In Pacific island, a number of studies have shown that urban dwellers with homegardens are better nourished than those without. In Honiara (Solomon Islands) people without homegardens were found to have a lower intake of iron and vitamins A and C (coming from traditional foods and the edible leaves of local trees such as *Moringa citifolia*, *Pisonia grandis* and *Plycias* spp). (Thaman, R.R., 1987, cited in Carter, 1994)

#### ◆ Solid waste recycling:

The use of organic waste as compost being already quite spread in urban agriculture. Of particular note in the current contexts is its common use in the cultivation of fruit trees and tree seedlings. In China, the utilisation of solid wastes is particularly well developed in virtually "closed systems" urban gardens (Honghai, 1992). Another aspect of organic wastes in cities is those acquired through the maintenance of parks and street trees. In a number of towns and cities in the developed world, tree pruning are chipped and used as mulch, while leaf material (including grass mowings) is composted. Similar systems may be possible in cities such as Hong Kong and Singapore, but in many developing countries it is difficult to envisage. Tree and grass trimmings have a greater alternative value as fuel or

fodder (Ranking and Joshi, 1992, cited in Carter, 1994)



### Urban forestry Creates Jobs

In Delhi, poor people gain income from the harvesting and sale of a number of products from trees growing on land owned by the Municipal Corporation.

#### Further Reading:

Carter, E.J. (1994). *The potential of Urban Forestry in Developing Countries: A concept Paper*. FAO, Rome. 90 pp. (English, French and Spanish).

FAO, (1994). *An annotated Bibliography on Urban Forestry in Developing Countries*. Rome. 100 pp.

Murray, S. (1997). *Urban and Peri-Urban Forestry in Quito, Ecuador: A Case-Study*. FAO, Rome. 104 pp. (English and Spanish).

El Lakany, H, Medhipour Ataie, A. Murrays, S. et al. (1999). *urban and Peri-Urban Forestry: Case Studies in Developing Countries*. FAO, Rome. 200 pp.

Unasylva, 1993/2. Vol. 44, no. 173. *Urban and peri-urban forestry*. FAO, Rome. [also available on

<http://www.fao/docrep/u9300E/u9300E00.htm>]

Kuchelmeister, G. (2000). *Trees for the urban millennium: urban forestry update*, UNASYLVA. <http://www.fao.org/docrep/X3989e/x3989e00.htm>. Paper, Web page.

Kuchelmeister, G. (1998). *Urban forestry in the asia-pacific region: status and prospects*. APFSOS Working Paper No. 44

Kuchelmeister, G. & Braatz, S. (1993). "Urban forestry revisited". *In* UNASYLVA, 1993/2. 44 (173): 3-12. *Urban and peri-urban forestry*. FAO, Rome.

Honghai, D., (1992). *Urban agriculture as urban food supply and environmental protection subsystems in China*. Proceedings of the International Workshop on Planning for sustainable urban development: cities and natural resource systems in developing countries, department of city and regional planning, University of Wales College of Cardiff; DPU, University College, London; Institute of Local Government Studies, University of Birmingham; IIED, London.

## URBAN AND PERI -URBAN AQUACULTURE



There are many options for the development of aquaculture in urban and peri-urban areas. The following are few selected examples:

### ◆ **Integration of Aquaculture with Rice farming**

It is estimated that about 20% of the irrigated rice fields may be considered suitable for fish culture. Even a modest adoption of integrated rice-fish culture system could dramatically increase income and food supply, particularly protein food supplies. Culture of fish in conjunction with rice can yield 50-300 kg/ha/crop. Alternatively, fish can be reared in rotation with the rice crop yielding an average of 300-3000 kg/ha/crop depending on the intensity of management, and on the climatic conditions prevailing in the location of the rice fields. Rice fields are found in peri-urban areas within a few hours distance from most cities in these countries.

### ◆ **Peri-urban Ponds**

The inclusion of commercial ponds, where not available, or the rehabilitation/upgrading of existing ones, would diversify farm output/redistribute risk amongst activities, and provide additional income to farmers and protein food supply for the urban markets. Aquaculture production levels from ponds will vary depending on: species selected (which could also include brackish water species in addition to freshwater ones);

and the level of inputs and management practice utilized. Production levels could range from 1500 to over 10,000 kg/ha/yr. Over 20 different species, including crustaceans, finfish and molluscs could be considered.

Such ponds can be either used exclusively for fish culture (i.e. not integrated with agriculture) or serve the double purpose of an on-farm irrigation reservoir and fish pond. The latter increase the efficiency of water use, diversify farm output/reduce risk, and provide additional income and protein food supply. In the case of stand-alone fish ponds, rehabilitation and improved management of existing ponds, and/or construction of new ponds would increase income to farmers. Fish production from both types of ponds will vary depending on inputs and management intensity, ranging from 500 to 5,000 kg/ha/yr.

### ◆ **Integration of Aquaculture with Livestock Rearing**

Several forms of integration exist, going from association of pig or chicken sties on the sides of the ponds or on stilts in the pond, to selected duck strains which not being piscivorous can coexist with fish fry and fingerlings in the ponds. The approach is to utilize ponds which are built for water storage and for livestock



drinking, also production of fish in a synergistic way. When in addition to the use of the pond for recycling of manures produced by livestock some agricultural by-products or processing wastes have been used (such as rice bran or cakes of various seeds used for oil extraction), fish production has attained annual levels ranging from three to seven tons of fish per hectare.

The approach is to manage ponds which are built for water storage and for livestock drinking also for production of fish in a synergic way, as the recycling of organic wastes from livestock would contribute to enhance the natural productivity of the water in the ponds, thus permitting high fish stocking densities and higher fish production. The selection of fish species for this model privileges those which feed on plankton or detritus. These species are frequently cultured together in order to maximize the utilization of natural food available in the pond. Tilapias and various species of carps have been regularly utilized to transform water productivity into edible fish protein. When in addition to the use of the pond for recycling of manure produced by livestock some agricultural by-products or processing wastes have been used, such as rice bran or cakes of various seeds used for oil extraction, fish production has attained annual levels ranging from three to seven tons of fish per hectare. Several forms of integration exist, going from association of pig or chicken sties on the sides of the ponds or on stilts in the pond, to selected duck strains which not being piscivorous can coexist with fish fry and fingerlings in the ponds.



URBAN AQUACULTURE (Photo FAO)

### Further Reading:

**Information on the integration of waste water and aquaculture from Hartwick College available at:**

<http://www.hartwick.edu/envirsci/Courses/hydroponics.htm#1>

**Small Ponds Make a Big Difference is available at:**

English version:

<http://www.fao.org/docrep/003/x7156f/x7156f00.htm>

Spanish version:

<http://www.fao.org/docrep/003/x7156s/x7156s00.htm>

Arabic version:

<http://www.fao.org/docrep/003/x7156a/x7156a00.htm>

Chinese version:

<http://www.fao.org/docrep/003/x7156c/x7156c00.htm>

### FAO TRAINING SERIES

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Volume 21/2 Management for freshwater fish culture: farms and fish stocks 1998. 341 pp. ISBN 92-5-102995-4

# URBAN AND PERI-URBAN AGRICULTURE

## OPPORTUNITIES & BENEFITS

### ◆ UPA IMPROVES FOOD SECURITY



A BASKET OF FRESH AND HEALTHY VEGETABLES (Photo FAO)

An estimated 1300 million persons throughout the developing regions live on the equivalent of less than one US dollar a day, it is also estimated that more than 800 million people, most of them in the developing countries don't have enough food to meet the basic nutritional needs.

### *UPA increases year round food availability and access to food*

UPA contributes to urban food security through increased food availability, stability and, to some extent, accessibility.

The production of staple foods in urban areas is seen as a coping mechanism in situations of severe food insecurity and is geared to household consumption in most regions of the world. In a Soweto case study, UPA was found to be a successful strategy for the immediate relief of hunger and malnutrition.



The contribution of vegetables grown in urban and peri-urban areas of Southern Africa ranges from 20% in Windhoek and Gaborone, 30% in Lilongwe and Blantyre, to 50% in Nampula and 50 -90% (according to the type of vegetables) in Dar es Salaam.



The horticultural species, as opposed to other food crops, have a considerable yield potential and can provide from 10 to 50 kg of fresh produce per sqm per year depending upon the level of technology applied. Due to their short cycle they provide a quick response to emergency needs for food (several species can be harvested 60 to 90 days after planting).

Although UPA production is, of course, influenced by seasons, it has also developed as a means of reducing seasonal gaps in fresh foods. It therefore contributes to the stability of urban food supply. Low income households benefit through their own production, i.e., producing foods that they would or could not otherwise buy, or from their involvement in processing and distribution activities.



*Fish is a food of excellent nutritional value, providing high quality protein and a wide variety of vitamins and minerals, including vitamins A and D, phosphorus, magnesium, selenium, and iodine in marine fish. Its protein - like that of meat - is easily digestible and favourably complements dietary protein provided by cereals and legumes that are typically consumed in many developing countries. (Photo FAO)*

### ***UPA increases food diversity***

UPA improves the quality of urban diets through diversification, by adding horticultural and animal products to the basis of staple food. This allows urban dwellers to consume a more balanced diet, that is not only sufficient in energy, but also in protein and micronutrients required for body growth and maintenance.

For instance, a major product of UPA, the egg is – the reference sample food, perfectly balanced, containing most essential amino-acids, large amounts of Ca, P, Mg, Iron, Zinc. It represents one of the main sources of Vitamine A and of Vit. B complex. It can be directly consumed through many delicious, easy to prepare recipes, or be incorporated in a lot of well- elaborated products.

## *Urban Agriculture, Household Food Security and Nutrition*

The contribution of urban and peri-urban agriculture to urban food security and poverty alleviation is being given increasing attention by policy makers. UPA appears to expand during economic crises, such as those induced by armed conflicts and structural adjustment, highlighting its use as a coping mechanism.

Urban and peri-urban agriculture contributes to food availability in cities and therefore to the diet of urban consumers. This is particularly important for fresh foods (horticulture, fruit, eggs, milk and poultry) which can be sold on the street, in markets or in local stores but also produced for home consumption (such as green leaves). But it is also true of staple foods, such as maize or sweet potato, which in many towns are produced for home consumption. This can be traditional like in Southern Africa but has become a common coping mechanism in situations of food insecurity.

*UPA contributes to poverty alleviation both through a reduction of expenditures and through an increase of income*

UPA also generates income for urban households involved in production, processing, marketing and distribution of these foods, allowing them to buy food and face other expenses. In general the urban poor spend 60-80 percent of their income on food. UPA contributes to poverty alleviation both

through a reduction of expenditures and through an increase of income. The income earned is usually spent on non-food items (e.g. transport, housing, school fees, health costs) and to a lesser extent, and especially by female producers, on food items.

On the other hand, urban and peri-urban agriculture also have environmental implications which can have positive or negative effects on urban health. It is important to understand these implications in order to prevent and/or mitigate them. This will require close collaboration with the health sector and appropriate interdisciplinary interventions. Ensuring safe food production, processing, handling and preparation practices is particularly important.



Women engaged in UPA activities close to home will be able to organise their time better and combine productive and domestic activities in a more satisfactory way than women that work far from their homes. They will save time on transport, have more time with their children and will be able to carry out a series of tasks which are essential to good health and nutrition (ensure hygienic environment and encourage healthy practices, take appropriate care of small children, sick and elderly relatives, take them to health facilities when needed...).



The contribution of UPA to the quantity and quality of food intake of urban consumers is widely acknowledged. The increased availability of fresh products allows urban dwellers to consume a more balanced diet, that is not only sufficient in energy, but also in protein and micronutrients required for body growth and maintenance.

*The contribution of UPA to the quantity and quality of food intake of urban consumers is widely acknowledged.*

This direct impact of UPA on household diets is increased when the income raised through vending UPA products is used to buy food items, such as cooking-oil. which can further improve the quality and quantity of the diet.

The benefits of UPA on nutrition will be further increased if people are given the information needed to make appropriate use of this food, through nutrition education, including promotion of balanced and affordable diets, child feeding, general hygiene, food safety, and appropriate household resource management.

Extension workers can therefore make a major contribution to improving food security and nutrition in urban areas by targeting food insecure households, promoting production of the foods required for a balanced diet year round and collaborating with relevant colleagues to ultimately ensure appropriate consumption of safe foods.



***Further reading:***

FAO (1999). [Field Programme Management- Food, Nutrition and Development](#) . A training package to assist fieldworkers in operating a rural development programme. 1999, 244pp. English - ISBN 92-5-104387-6.

FAO (1995). [Improving Nutrition Through Home Gardening: A Training Package For Preparing Field Workers in Southeast Asia](#). Contains course materials and technical notes for trainers and participants, and home garden technology and nutrition information leaflets for farmers and their families. 1995, XX pp. English - Job Number V5290E.

FAO (2000) [Mejorando la nutrición a través de huertos y granjas familiares: manual de capacitación para trabajadores de campo en América Latina y el Caribe](#). Este material de capacitación integra aspectos de producción agropecuaria con aspectos de nutrición y seguridad alimentaria, y ofrece pautas para la realización de acciones conjuntas en varios sectores y disciplinas para encontrar soluciones adecuadas y sostenibles a los problemas de inseguridad alimentaria y desnutrición. 2000, 248 pp. Spanish - Job Number V5290S.

◆ **UPA CREATES EMPLOYMENT**



**UPA employs 800 million urban residents worldwide**

Potential horticulture jobs created through UPA are one full time job every 20-50 urban consumer. The intensive horticultural and livestock production that thrives in peri-urban areas employs workers and produces high value-added products that can yield reasonable income and returns with a land use of 10-20 full time growers per hectare. Women, who can combine the food production process with childcare and other household responsibilities, are often involved in UPA on a part-time basis. In addition to direct employment there will be opportunities for induced jobs in relation to equipment and input supply including liquid fertilisers, compost making and platelets, technical servicing and marketing.

**UPA generates jobs and income**

Income can be as much as double from casual labour wage. Horticulture is renowned for being a labour intensive activity. Labour requirements for full time occupation can reach 20 to 40 active labour per hectare. On small plots of 250 to 500 sq. meters, commercial

producers can obtain sufficient revenue to sustain their family.

**UPA improves the socio-economic standards**

Vegetable and ornamental plant production have generally proven to be rewarding, they fetch high prices, not only on the local market, but also from export.

Families are involved with recycling activities and on a part-time with services (like compost provision), enterprise development and marketing.



(Photo FAO)

**INCOME GENERATION THROUGH MARKETING OF UPA PRODUCT**

Base income for a full-time worker with a worm farm is estimated at about US\$ 200 per year.

In Delhi, poor people gain income from the harvesting and sale of a number of products from trees growing on land owned by the Municipal Corporation. Maintenance and harvesting of wood and non wood products from municipal

and communal greenbelt and other trees plantations create jobs all over the year.

The impact of the project on each of the participating countries is likely to vary with the level of economic development; the industrial level; etc. Funding and effort will largely be channelled into initiatives in the poorest parts of the countries – to help alleviate poverty.

#### ◆ UPA CREATES GREEN ZONES WITHIN & AROUND THE CITIES



Urban forestry can have an important productive role in urban and peri-urban areas. Many developing countries have been active in establishing plantations and managing natural forests in peri-urban areas for fuelwood production to supply urban markets. In some cities, agroforestry practised in home gardens makes an important contribution to family nutrition.

A broad understanding of urban forestry focuses on using trees to provide food, fodder, fuel and building material, but also considers recreational and environmental benefits. It contributes immensely to the quality of life in towns and cities in the region.

In low-income settlements the most important benefits of the urban forest may be directly productive ones such

as supply of building materials, fuelwood and even fodder. But beyond the products provided, the main function of trees may be to sustain agriculture and ecosystems by the protection of water-supply catchments for the cities, protection against landslides, climate mitigation. Yet others are aesthetic - the beauty and the room offered for recreation. Some roles cannot be quantified in money terms but this does not mean they are any less important.

**Urban greening** means the planning, and managing of trees, forests and related vegetation to create or add values to the local community in an urban area. Trees have multiple functions as an integrated part of the urban food system: they provide food (fruits, roots and leaves), medicines, shade for crops and animals, fodder for the animals, and they deliver organic material for composting. In the past these benefits of trees have often been overlooked, as conventional forestry concentrated on the environmental benefits and recreational value of urban vegetation.

#### **Climatic modification**

Tree planting for micro-climate amelioration in cities as Nanjing, China have demonstrated that the drop in the average summer temperature is directly attributable to the cooling effect of trees (block afforestation of degraded hillsides, windbreaks, triple rows of trees along railways, and the lining of street sides). While the primary effect is energy saving (air conditioning), another positive impact is on the water cycle and water conservation for agricultural activities.



### ◆ UPA HELPS TO RECYCLE SOLID AND LIQUID WASTES

Urban and peri-urban agriculture contribute to a reduction in waste management problems in various ways: In some cities waste is regularly burned in the streets because there is no collection system in place. This creates serious problems of air quality and contamination.



*UPA helps closing the energy loops  
and transforming waste into  
biodiversity*



The recycling of large amounts of organic waste (e.g. in India) helps to reduce this problem in part. In other places (e.g. in the Dominican Republic) it is observed that the owners of open space within the city plant crops on open spaces expressly to avoid illegal waste disposal. This tactic is effective since people respect planted areas more than unused spaces.

Urban solid waste management is closely related to the availability of fertiliser and the contamination of potential production sites and herewith indirectly to health.

Urban producers achieve real efficiencies by making productive use of under-utilised resources, such as vacant land, treated wastewater, recycled waste and unemployed labour. Productivity is often

substantially higher than in rural areas considering the intensified agriculture practices.

Many individuals and NGOs are already involved in waste recycling activities in cities. Hereby organic waste is used for animal fodder and composting, animal waste is used for gardening and solid waste is transformed into tools and other equipment.

If properly processed animal waste is a high value fertiliser. In integrated urban food production systems large amounts of manure re-enter the nutrient cycle as fertilisers for crop and vegetable production.



**WASTE METAL RECYCLING** (Photo  
Drescher)

One example comes from an FAO pilot project. Acting on the principle that sewage is not just wastewater but also a source of nutrients, an experimental plant in operation since 1994 treats sewage with aquatic weeds and fish.



Fish farms contribute to the recycling of organic waste and urban wastewater nutrients.

One million litres of primary treated sewage a day sits first in ponds containing duckweed then in ponds stocked with carp and prawns. After five days, water quality has improved to the point where it may be used for agriculture, although not for drinking. Fish in the sewage ponds is sold after 8 to 12 months.

### Wastewater recycling

Water is clearly a resource of particular potential value in arid and semi-arid areas, where nutrient-rich wastewater can be an important input for agriculture or forestry. Due to the possible health hazard, wastewater is more suitable to grow non-food tree crops than for human consumption. The raising of trees using wastewater irrigation is already practised in Lima, Cairo and Jordan.



**SIMPLE TOOLS FOR IRRIGATION  
MADE FROM WASTE METAL** (Photo

Drescher)



**WASTE METAL RECYCLING** (Photo  
Drescher)

### Other benefits of UPA:

- J · Access to consumer markets
- J · Reduction in post-harvest losses
- J · Less need for packaging, storage and transportation of food
- J · Proximity to services, including waste water treatment facility



# URBAN AND PERI-URBAN AGRICULTURE

## STRATEGIES FOR SUCCESSFUL IMPLEMENTATION

UPA presents complex interactions of social and environmental phenomena in locations that are changing fast but without adequate financial support. The future habitability of cities in developing nations will depend on whether decision-makers and urban planners develop and adhere to coherent policies for managing their urban and peri-urban areas.

UPA falls under the jurisdiction of several different levels and types of authorities (e.g. agriculture, forestry, parks and gardens, public works, transportation, urban planning), coordination and information sharing is needed for a comprehensive policy approach.

The municipalities and states should make efforts to formulate and implement urban development policies based on guidelines and models of expansion that take into account the need to reserve areas for tree plantations, agricultural and vegetable production purposes, thus giving the urban centres and their outskirts the possibility to feed a large part of the population with strictly local production.

It is necessary to design urban development plans that impose specific norms for the utilisation of the soil, banning unauthorised construction and creating large areas for vegetable and fruit production within sustainable systems in the cities and their immediate surroundings.

An adequate legislation, long-term heritable leases, leasing of the plots and gardens through a contract recognised by the municipality and correctly registered are measures, which would guarantee usufruct rights by the potential farmers, vegetable growers and livestock producers.

### **Intervention Modalities of the SPFS:**

**Intervention modalities may include:**

**(a) Diversification. Diversify the range of horticultural crops systems for year round market supply and introduction of new vegetable, non wood forest products and ornamental crops and livestock products to target specific market niches**

**(b) Intensification. Development of appropriate and sustainable intensive technologies for increased horticulture and livestock productivity to meet year-round market demand.**

**(c) Product Value-Adding. Promotion of appropriate small-scale agro-processing, including peri-urban products where raw materials and market demand for processed products are available.**

## REQUIREMENTS FOR PLANNING, IMPLEMENTATION AND IMPROVEMENT OF UPA

J · Creation of governmental and municipal awareness

J · Site survey - Identification of current and potential sites for UPA

J · Identification of stakeholders and institutional framework (prime contact)

J · Identification of potential for cultivation practices

J · Identification of main constraints to agriculture and greening

This may result in:

- è · The integration of UPA in urban resource management
- è · Sustainable production systems

## FIRST STEP: EVALUATION OF BASIC DATA



Availability of space for agriculture

- £ · Where is UPA practised and how are the tenure conditions - who owns this land and how are the institutional arrangements (toleration, leasehold, illegal etc..)

£ · Availability of water, quality of water and the potential for irrigation

- £ · Assessment of soil quality
- £ · What is already done on the ground ?
- £ · Farming systems analysis

*Note: If basic data are not available through municipalities: link the basic survey with research institutions (universities, Private research companies etc.). The use of Geographic Information Systems facilitates evaluation and analysis. Co-operation with existing programmes facilitate site selection.*

## SECOND STEP: STAKEHOLDER ANALYSIS

£ Who are the Possible stakeholders ?

- š Male and female farmers households, elderly, children?
- š Landless poor
- š Urban squatters
- š Local institutions (municipal authorities)
- š Land owners (public – private)
- š Government staff on target group/ grass-root level
- š NGOs/ CBOs
- š Projects (donors)

- š Urban communities, women groups
- š Private sector
- š Religious groups
- š Interested Individuals

*Note: As consequence of the results to these questions it is necessary to think about how to best help the farmer to organize themselves (co-operatives, water user groups, women groups, farmer associations etc.)*



## THIRD STEP: IDENTIFICATION OF FIELDS OF INTERVENTION

£ Which modules should be promoted ?



- Home gardens - Micro Gardens - Hydroponics - Community Gardens  
Potential sites: rooftops, balconies, backyards, walls (edible buildings), road strips, river banks
- Livestock - chicken, goats, others
- Aquaculture - fish, shrimps in fishponds, rivers
- Urban forestry - agro forestry systems, fruit and fodder production, non wood products etc

*Note: In most cases it is more efficient to promote already existing modules and help to improve them, instead of creating new, artificial modules which are not known to the stakeholders, not adapted to the local situation or not accepted.*



## FORTH STEP: ANALYSIS OF TECHNICAL ISSUES

### - THE ROLE OF EXTENSION SERVICES



What are best suitable practices ?

- Ø Irrigation techniques
- Ø Integrated production systems
- Ø Soil improvement (e.g. composting)
- Ø Pest management
- Ø Credit provision and community saving schemes
- Ø Book keeping systems

What infrastructure is needed ?

- Ø space, water wells, taps, roads, footpath, input supply etc.



### *THE ROLE OF EXTENSION SERVICES*

Formal agricultural extension services in urban agriculture are extremely limited to not existent. In most Southern African Countries for example, traditionally the extension services serve the rural farmers in staple food production. Urban and peri-urban agriculture is hardly ever recognized as being an important subject to extension. Through training, educational programming, communication and community organization, urban-based extension services can help UPA farmers select appropriate crops, schedule production, improve harvesting techniques and reduce post-harvest losses, while ensuring that adequate attention is paid to food safety throughout the food chain. They can also coordinate inputs, transportation, storage and credit. Extension can help farmers get optimum prices for their produce by having them acquire new skills such as grading and sorting.

They can also assist individuals and businesses in food processing to take advantage of surpluses and add value to produce. Extension services can facilitate the two-way flow of information, thus helping farmers know what consumer want and need.

Extension and advisory staff need the necessary background theory to understand why certain interventions are necessary and how they work. More importantly they need the practical skills to be able to demonstrate interventions to farmers. This level of training can be provided through short in-service courses.

Activities should concentrate on developing local skills (farmers and extension staff) through short practical training sessions preferably held on plots – consider a modified farmer field school approach.

In order to get familiar with the new environment and different technical and social context of UPA the training of extension staff who will be called to work in this new context is an important activity to be promoted. Training needs to focus on refresher courses on content (technical subject matter) and methodology in particular in working with groups of both male and female UPA small farmers. In urban sectors, where dwellers have access to agriculture extension services, women's involvement has been widely ignored. Urban extension programs need to be specifically targeted to women farmers ensuring fair proportional access to women, particularly poor, women-headed households. Distance to training sites, lack of transportation and child care facilities, unfamiliar jargon,

**Urban extension programs need to be specifically targeted to women farmers**

and male trainer bias in workshops and training programmes have kept women farmers from participating. To increase the number of female beneficiaries receiving agricultural extension services, the number of female agricultural extensionists working in the field must increase. Extension agencies and beneficiaries rate the work conducted by their female agents highly. In the case of extension managers, precaution should be taken so that the UPA extension is considered as a complement to the conventional agricultural and rural extension and not a mere substitute, in particular in countries experiencing mobility constraints. Extension for UPA should not be interpreted as a solution for lack of transportation in developing countries but rather an extra effort to improve food security, taking advantage of the potential of production available within and around places with high population concentration.

## WHO NEEDS TRAINING?

Target groups for training on UPA may include:

- €# extensionists;
- €# urban farmers;
- €# associated enterprises e.g. in input supply, processing and marketing;
- €# support providing institutions e.g. GOs, NGOs, donors and financial institutions, extension services;
- €# policy and decision-makers;
- €# institutions with legal functions, and
- €# planning authorities

**Basically agro-technological issues in urban and peri-urban areas do not vary much from what is proposed to rural small scale farmers. Nevertheless there are differences regarding scale of production, type of crops grown, and proximity to services and markets.**

## GENERAL RECOMMENDATIONS FOR EXTENSIONISTS

*Training and extension should consider.....*

- ⌘ Demonstration plots within urban and peri-urban areas.
- ⌘ Information on "Integrated Nutrient Management" and "Integrated Production and Pest Management", IPP.
- ⌘ Farmers' field schools and training for extension staff in urban and peri-urban agriculture.
- ⌘ Training on safe use of agro-chemicals for both suppliers and farmers.
- ⌘ Provision of information systems translated into farmers' language, including capacity building in marketing/business.
- ⌘ Documentation of indigenous knowledge of urban and peri-urban agriculture.



### EXTENSION SERVICES

Woman extension worker teaching woman farmer how to plant and cultivate vegetables in home garden. An example from the Asia-Pacific region. (Photo FAO)

Cultivation practices, crops, climate and culture vary widely from continent to continent (Annex I). Specific extension guides for all the single modules of Urban and peri-urban agriculture are not yet available.



Home gardening as one most accepted component of UPA is addressed by various handbooks for farmers and extensionists. An FAO training package, **Improving Nutrition Through Home Gardening** is designed for the instruction of agricultural extension, home economics and community development agents working with households and communities in Southeast Asia to promote home gardening for better nutrition. A new edition for the African continent is in preparation.

Support of home gardens can be a contribution to strengthening food security and biodiversity for ecological stability. The farming system itself is also influenced by home garden activities and support on home gardens can have far reaching impact on the farming system.

Areas needing extension support include; methods of improving water use efficiency, storage and marketing of home garden products. With respect to its contribution to sustainability, food security and ecological stability, home gardens should not be addressed in isolation.

While home gardening contributes significantly to food security, however there is need to address home gardening as part of the farming and livelihood system as well as other components like e.g. wild fruit gathering or staple food production.



**HOME GARDENS ARE BECOMING A MORE AND MORE IMPORTANT SOURCE OF FOOD IN DECLINING ECONOMIES** (A picture from Africa, FAO)

**Further reading:**

The question of how to help small farmer group associations was discussed in an FAO email conference from 24 September-11 November 1998. Information is available on the FAO Web site: <http://www.fao.org/sd/ppdirect/ppfo0008.htm>.

**More information on planning for urban agriculture is available at:**

Jacobi, P., A.W. Drescher & J. Amend (2000). *Urban Agriculture - Justification and Planning Guidelines*. GTZ, Eschborn. <http://www.cityfarmer.org/uajustification.html>

Dongus, S. (2000): *Vegetable Production on Open Spaces in Dar es Salaam - Spatial Changes from 1992 to 1999* <http://www.cityfarmer.org/daressalaam.html>

Drescher, A.W. (1997): *Management Strategies in African Homegardens & The Need for New Extension Approaches* <http://www.cityfarmer.org/axelA.html#lusaka>

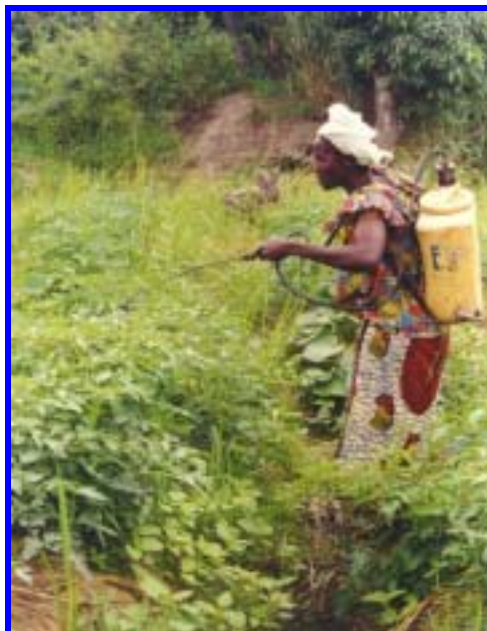


## URBAN AND PERI-URBAN AGRICULTURE

### THE CONSTRAINTS & HOW TO DEAL WITH

#### EXCESSIVE USE OF AGRICULTURAL INPUTS

Inappropriate or excessive use of agricultural inputs (pesticides, nitrogen, phosphorus, raw organic matter containing undesirable residues such as heavy metals) which may leach or runoff into drinking water sources; microbial contamination of soil and water, including by pathogens. Extension services can play a leading role in the advice on appropriate adjustment of input supply.



PESTICIDE SPRAYING (Photo FAO)

#### LAND TENURE



Land tenure is often a critical constraint since most farmers do not own their land. Availability of and access to land and water are fundamental requirements for the urban dwellers to enable food production. This has been a key constraint to tree planting, as trees are often considered by laws and customs, as “markers” for claiming lands. Therefore basic questions are how to increase access to land for the

poor and how to integrate the urban poor into the urban land market.

The high level of illegal occupation of land, high prices of urban land, the small dimension of lands, and the need for immediate income may represent major constraints for tree planting. In most urban environments, space is precious, and subject to many competing land use pressure. Much of the challenge of urban forestry lies in making optimal use of the limited area available for urban trees and to encourage tree-based production systems responding to the landscape and ecosystems requirements.

The challenge for urban planners is to integrate coping strategies of the urban poor-- which are closely related to the

informal land market in many countries -- into their planning strategies.

This requires the definition of rules and standards but also ways to increase the supply of and access to land by the poor and implementation of land legislation to enable sustainable urban development.

**Planning requires the definition of rules and standards but also ways to increase the supply of and access to land**

Recently, gender aspects have entered into the discussion of planning and agriculture in cities. Women as major players on all levels of the urban food system, in production, marketing, processing and street food vending have a basic interest in being considered as an important interest group for urban planners

. A quick and reliable method for an evaluation of the peri-urban agricultural economy, the magnitude of its growth and evolution (by aerial photography, interpretation of satellite images which would show for example the areas under cultivation) need to be designed.

Geographic Information Systems (GIS) offer good opportunities to integrate data from various sources and allow effective planning.

***Challenge to Micro Finance***

Low Income households with (peri)-urban agricultural activities have difficult access to credit. This is because Micro Finance Institutions typically provide small loans for fast income-generating and less risky activities such as small trading and services.

Providing adequate savings facilities together with complementary credit in order to finance essential inputs such as seed and fertilizers as well as tools, would assist low-income households with the means to generate additional food and income.

Micro credit support for processing, storage and refrigeration would raise the income potential of urban farmers and improve the safety of food sold by street vendors, who rely heavily on urban and peri-urban production.

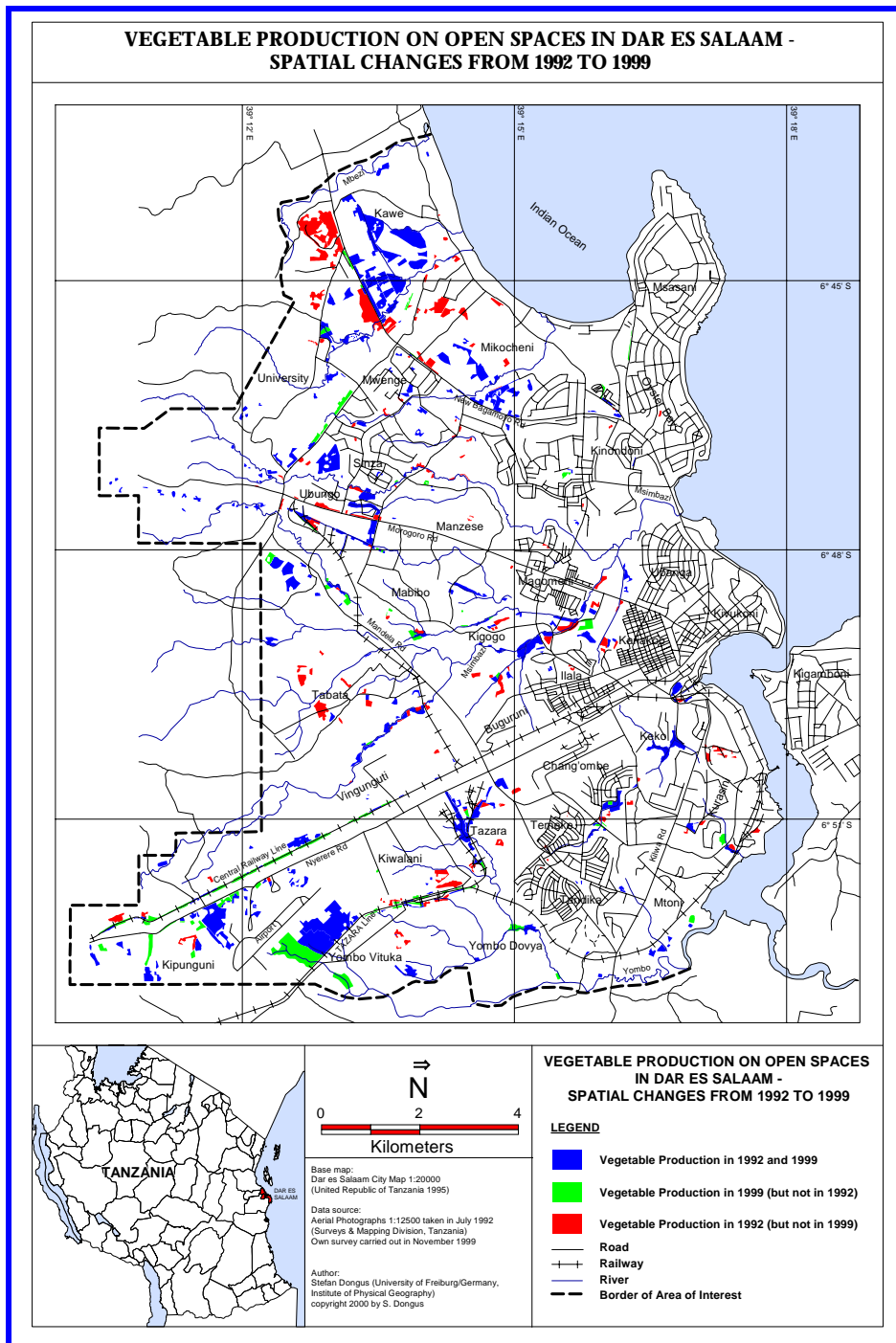
Micro credit is the extension of small loans to entrepreneurs too poor to qualify for traditional bank loans.

It has proven an effective and popular measure in the ongoing struggle against poverty, enabling those without access to lending institutions to borrow at bank rates, and start small business. But with the current explosion of interest on micro credit issues, several developmental objectives have come to be associated with it, besides those of only "micro" and "credit". Of particular importance is that of savings - as an end in itself, and as a guarantee for loans.

Micro credit has been used as an 'inducer' in many other community development activities, used as an entry point in a community organizing programme or as an ingredient in a larger education/training exercise.

Source: *The virtual library on micro credits* <http://www.gdrc.org/icm/>





**USE OF GEOGRAPHIC INFORMATION SYSTEMS FOR MAPPING OF AGRICULTURALLY USED OPEN SPACES IN DAR ES SALAAM** (Source: Dongus 2000)

Communities could be supported through the establishment of savings and credit schemes e.g. “micro banks for the poor” or community based saving agreements. The Grameen bank model is currently one of the most successful micro finance instruments to help the poor., but its replication under

other conditions is not automatic and it has a limited focus on agriculture.

*Currently, there are estimated to be about 3,000 micro finance institutions in developing countries. These institutions also help create deeper and more widespread financial markets in those countries.* UN Secretary-General 1997

## The Women's Bank in Sri Lanka

The Women's Bank is a cooperative bank, with saving and loan groups and bank branches. Members of a group meet weekly. The leaders of all groups in one bank branch meet monthly. All members (or their representatives) of the Women's bank meet once a year.

To be eligible for membership of a group, a woman will have a low income, she must reside in a poor-income settlement area and she must be willing to participate in group activities according to a set of rules and regulations. Only one member of a household can participate in a particular group and only persons who trust each other can be members. The groups consist of 5-15 members only; no money lender can join the group and the group leader cannot be actively involved in party politics.

Source: The Virtual Library on Microcredit  
<http://www.gdrc.org/icm/inspire/womenbank.html>

In order to enable the farmers to enter into saving agreements training for numeracy and simple bookkeeping is needed. This is for example successfully practised with urban farmers in Dar es Salaam.

Those training courses enhance the management skills of micro business entrepreneurs and thus not only increase the income potential of their productive activities, but also improve their self-esteem, and their status in the community. Increased self-esteem helps women build their confidence with outside partners and open their perspectives to further development

It is important that social and economic support programmes include managerial capacity building of the individuals / groups they aim to assist, as this is the only way that such programmes can achieve a lasting effect.



TRAINING URBAN FARMERS IN BOOK KEEPING IN DAR ES SALAAM

(Photo: Drescher)



In this regard, it is recommended that Home Economics Institutions consider or enhance curriculum components preparing their students for development approaches, catering for social AND economic needs of their ultimate target audience. Seldom will social advancement be achieved without economic betterment and improvements in individuals' economic situations will most likely contribute to increased power and participation in household and community decision-making. This will contribute to linking micro-level improvements with intermediate and national level development opportunities.

**Further Reading:**

**More Information on constraints, planning, food security and environmental issues related to urban and peri-urban agriculture is available as a final report of an FAO/ETC electronic Conference:**

**FAO (2000). URBAN AND PERIURBAN AGRICULTURE ON THE POLICY AGENDA. Virtual conference and information market, August 21 - September 30, 2000, Final Report. By Drescher, A.W., R. Nugent & H. de Zeeuw <http://www.fao.org/urbanag/>**

### ***STRENGTHENING SMALL SCALE FARMERS: The "small group" approach***

For FAO, bringing the rural poor together - in groups of 10 to 15 people - is the starting point of participation. This concept could be modified and transferred to the urban sector as well. It's plain common sense:

- J · First, groups offer significant economies of scale. Individual small farmers can't afford to undertake activities that involve additional investment or risk. But a group of people can share costs by pooling their ideas, capital and labour.
- J · Second, groups are cost-effective receiving systems for development assistance. Most governments do not have the staff or funding to reach each and every rural household. But when their clients are organized in

groups, it is far less costly to deliver inputs, training, credit and other services.

- J · Groups foster collective learning. Individual farmers have particular talents and skills - but don't have the opportunity to share them with their neighbours. In a group, they can learn from each other, and share valuable new skills as well.
- J · And groups promote democracy. As individuals, the rural poor expect to have little or no say in decision-making. In a group, they learn to discuss and solve problems together. They elect their own leaders and hold them accountable. Later, they apply these principles in community life.

But groups of people sometimes drift apart. Friends argue. Businesses fail. How then do FAO projects ensure that farmers' groups remain cohesive and sustainable?

*Experience from the FAO's Peoples Participation Programme (PPP) project in Zambia:*

*"We operate through what we call group promoters. They are trained for two weeks in the small group approach, then assigned to an extension area. The group promoter in each area will carry out a survey to find out what services are available, the resources and activities that are going on, and identify the people to be our beneficiaries.*

*"When we introduce our approach to the farmers, we sit and talk with them, and it is finally the people who agree on whether they make a group or not. These groups have to be small, manageable and the group members should be of such a level - both social and economical - that they can understand each other. In these groups they are taught to work together, leadership skills, how to keep records and how to carry out income-generating activities.*

*"Thereafter, if the members are willing to undertake any other new ventures, then the group promoters will act as link between the groups and any other organization that will give the service of knowledge to the groups."*

*Source: <http://www.fao.org/waicent/faoinfo/SUSTDEV/FSdirect/FBdirect/FSP006.htm>*



**Source and further reading at:**

**FAO 2000a:** "FAO supports the Nineteenth Congress of the International Federation for Home Economics" <http://www.fao.org/sd/wpdirect/wpre0133b.htm>

This collection of papers provides more information on various topics related to home economics.

### BOX 3 THE IMPACT OF THE NUMERACY AND SIMPLE BOOKKEEPING TRAINING PROGRAMMES

Training in numeracy and bookkeeping systems leads to:

J · increased skills and knowledge,

J · greater trading skills and higher returns, and

J · improved self-esteem and general well-being

£ · **Increased skills and knowledge**

J · able to avoid being cheated (by literate people);

J · recognise the need to handle their business in a professional manner, irrespective of its size;

J · able to distinguish between money "left over at the end of the day" and profit;

J · able to cost & price services or goods correctly and to determine the actual profit obtained;

J · enhanced analyses of -financial- issues before decision-making;

J · able to determine where and when the greatest profits could be obtained, sometimes leading to diversification of the activity;

J · more cautious about spending and trading: rational decision-taking on most profitable products, services or investments;

J · able to weigh cotton, to write down the weight of the cotton and to calculate the income which should be obtained (Togo);

£ · **Greater trading skills and higher economic returns**

J · nearly two thirds of the interviewed learners of the initial courses reported a tripling of their economic returns;

J · 3/4 of the interviewed learners of the initial courses had started to save money and the majority of them reported reinvesting part of their savings into their business;

J · learners reported that they sell other things to re-invest.

£ · **Improved self-esteem and general well-being:**

J · an improved self-esteem:

J · "improved public image" = increased status:

J · increased harmony in the family as they are able to maintain proper accounts and to discuss financial matters rationally;

J · extra income is being spent on increased family food intake, school fees, possibly reflecting the impact of nutrition education programmes or showing the need for increased expenditures in these areas;

J · increased enrolment of their children into schools;

J · helping their children with maths homework and being able to judge their marks (children are even using their books);

J · emanating desire to continue learning;

# WATER, SOIL, AND PEST MANAGEMENT

## WATER AVAILABILITY, QUALITY AND SAFE PRODUCTION

Water is scarce in many urban centres and both water and sewage systems are not designed for the increasing population. Water supply for agricultural uses in cities is not planned for in most cities.

Therefore (peri) urban agriculture is to be promoted in such a way that it does not compete with other urban water needs, is environmental friendly and does not pose risks to human health. Rapid urban expansion has resulted in a large flow of unmanaged wastewater. This does not only threaten the immediate surroundings of the urban and industrial centres but also affects downstream water resources. It causes severe environmental pollution, threatens public health and makes water resources less or unsuitable for other potential beneficial uses, including food production in the (peri) urban and rural areas.

Only 8 to 10% of the sewage waters are properly managed in Africa, Asia and Latin America (Biswas, 2000)

### *Microbiological quality guidelines for wastewater use in agriculture*

	Reuse condition	Exposed group	Intestinal nematodes (arithmetic mean no. of eggs per litre)	Faecal coliforms (geometric mean no. per 100 ml)
<b>A</b>	Irrigation of crops likely to be eaten uncooked, sports fields, public parks	Workers, consumers, public	$\leq 1$	$\leq 1000$
<b>B</b>	Irrigation of cereal crops, industrial crops, fodder crops, pasture and trees	Workers	$\leq 1$	No standard recommended
<b>C</b>	Localised irrigation of crops in cat R	None	Not applicable	Not applicable

Health hazards associated with water pollution relate to the accumulation of heavy metals, and carcinogens, mainly organic chemicals, in crops. Two of the best know examples of heavy metal pollution that can cause health concerns are cadmium and selenium. Pathogenic organisms give rise to the greatest health concern in agricultural use of water contaminated by urban wastewater. Although there are no specific water quality guidelines for pathogenic contamination of irrigation water the WHO microbiological quality guidelines for design of wastewater treatment might be used to evaluate the health risk of the use of polluted water sources for irrigation. These guidelines are based on the survival times of excreted pathogens in water, soil and on crop surfaces and in combination with the irrigation conditions.





### *Promotion of safe production*

The Accra Metropolitan Public Health Department has recorded an increase in the incidence of intestinal diseases among children in the metropolis due to the consumption of contaminated food, especially vegetables eaten raw. The main source of vegetable contamination identified by the Accra Laboratories is the water of very poor quality used for irrigating the vegetables at all sites within the metropolis. This problem received large attention from national and international media, causing negative impacts on trade and tourism. Provision of safe water for irrigation in combination with a certification programme might be a solution.

Water from shallow wells might also contain a high level of contaminants if they are not protected against intrusion of run-off drainage water. Microbiological contamination also occurs in open and tubewells as well as springs that are located within approximately 30 meters of a contamination source e.g. pit latrines. Besides, water from shallow wells can be contaminated with high levels of salinity and toxic trace elements, either natural or through groundwater flow from a pollution source. At present arsenic contamination of wells in the Bangal is a serious problem.

Where water sources do not meet the WHO water quality guidelines for irrigation measures will need to be taken to lower risks to public health. The most widely used measure is crop restriction. The success of crop restriction programmes greatly depends on whether the wastewater use occurs in a defined area. Reality in many developing countries, however, is that the wastewater - treated, partially treated and untreated - is discharged directly to surface waters and these are again diverted downstream for irrigation purposes. This unrestricted discharge leads to widespread distribution of the

wastewater and makes crop restriction extremely difficult.

Developing a programme to promote safe production areas is an alternative to crop restrictions and can be done with a three-phased process. Each phase depends upon the successful completion of the previous phase. The first phase is to develop a sound information base (water quality monitoring phase) that can be used to evaluate the existing levels of contamination (water quality) in the water being used for production. The second phase involves evaluating the water quality data collected in the first phase and developing procedures to

assess the levels of contamination (data analysis and evaluation phase). The overall goal of both Phases I and II is to ensure that the database can be used to define safe production areas. The third and final phase of developing a programme to promote safe production areas is developing mechanisms to regulate the use of contaminated water on vegetable or other high-risk crops (water certification phase).

### Water certification programmes

Certification programmes focus on the source of water used in production. Two approaches can be adopted i.e. certification of the water used in an irrigated area or certification of water

used on a specific crop or field. The choice depends greatly on the staff and financial resources that are available as well as the characteristics of the water and pollution sources. Certification of the water used in an irrigated area can be done if the water that is distributed and used throughout the irrigation network does not change in quality. This type of certification can be done for organised growers' schemes in open urban spaces and peri-urban areas. For families that have access to small-size plots normally living in populated urban areas and who do not make use of the same water source or where secondary contamination is likely to take place certification of water used on a specific crop or field is more applicable.

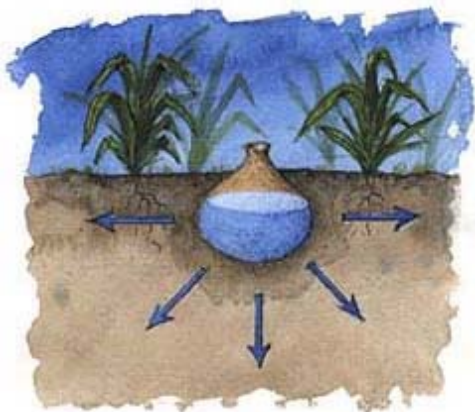


**IRRIGATION WATER USED FOR WATERING IN THE URBAN GARDENS IS NOT ALWAYS SAFE AND CLEAN. An example from Dar es Salaam (Photo Drescher)**



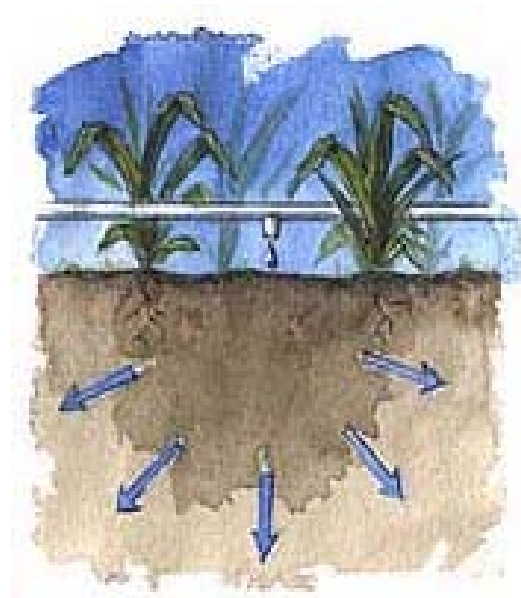
### *Box 4 Locally adapted small-scale irrigation systems*

Locally adapted small-scale irrigation and plant production methods and schemes are possible solutions to save water. To alleviate the water problem, new water-saving sub-surface irrigation methods are used.

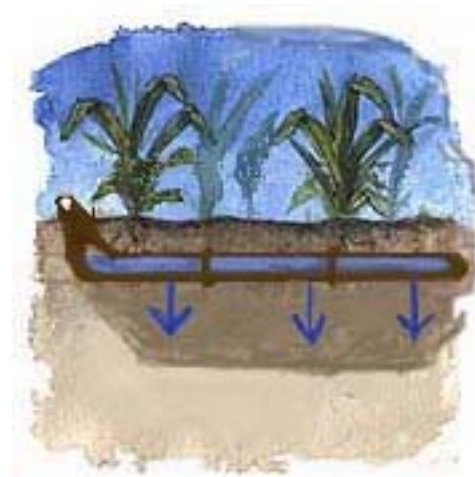


*The use of porous jars buried up to the neck is one of the oldest irrigation methods and is practised by traditional farmers throughout North Africa and the Near East*

*(Source: FAO)*



*Drip irrigation - the slow, localised application of water, literally drop by drop (Source: FAO)*



*A new water-saving sub-surface irrigation method, using underground clay pipes (approx. 10 cm diameter) has recently been introduced by an ODA-funded community development project in Zimbabwe.*

*(SOURCE: after Drescher, Hagmann & Chuma 1999, modified)*



## SUMMARY OF SMALL-SCALE IRRIGATION METHODS

### Methods based entirely on local materials and workmanship

- ⌘ Low-fired porous ceramic pots are placed on the surface or embedded in the soil within the root zone. When filled with water and dissolved fertilizers, the permeable clay receptacles ooze water and nutrients into the soil.
- ⌘ Sectioned ceramic pipes constitute line sources that feed elongated beds.

### Methods based on imported materials but local fabrication

- ⌘ Moulded plastic pipes or extruded plastic tubing are perforated manually and laid over the ground to simulate drip irrigation.
- ⌘ Vertical sections of plastic pipes (or even discarded plastic containers such as bottles) are embedded in the ground.
- ⌘ Thin-walled plastic vessels are filled with sand or gravel to provide mechanical resistance to crushing.
- ⌘ Slit plastic sleeves cover the perforated sections of the tubes to prevent root penetration into the outlet holes.
- ⌘ Sand filters prevent suspended particles or algae from clogging the outlets.
- ⌘ Auxiliary containers are used to dissolve and inject fertilizer into the irrigation water.
- ⌘ Vertical standpipes are used to deliver water from an underground pipe to small basins.

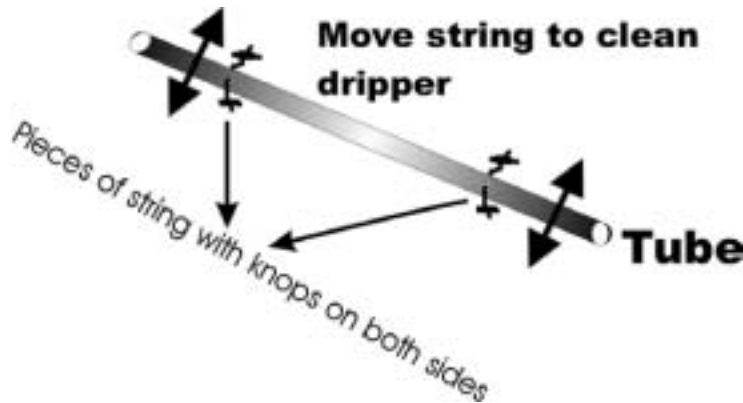
### Methods based on imported components\*

- ⌘ Manufactured drip emitters and micro sprayer assemblies are carefully supervised and maintained.
- ⌘ Ancillary equipment such as screen and media filters, metering valves, pressure regulators and fertilizer injectors are used in various combinations.
- ⌘ These options will be justified only for cash crops in a stable market economy.

Source FAO Web News 1997 : <http://www.fao.org/news/1997/970704-e.htm>

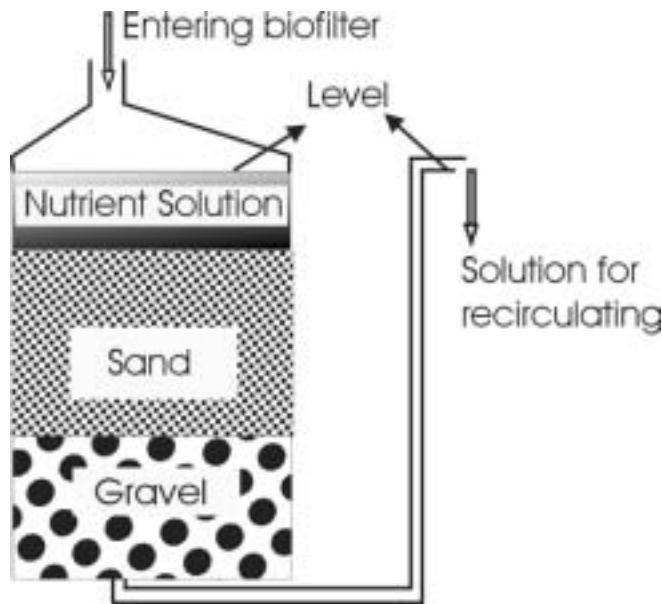


Blocking of irrigation tubes is a major problem in drip-irrigation. A self-made drip system which prevents the system from blocking has been developed in South Africa.



### *Simple self-made drip system*

A simple bio-filter helps to recycle high value nutrient solutions, which can be used either in drip-irrigation systems or in hydroponics. The effluent is filtered through layers of sand and gravel. No diseases developed up to date after transplanting four months ago.



### *Schematic illustration of an adapted bio filter*

(Source FAO 2001)

### **Further readings on irrigation, water quality, wastewater reuse and safe production:**

FAO (1985) Irrigation Water Management: Training Manual No. 1 - Introduction to Irrigation  
<http://www.fao.org/docrep/R4082E/R4082E00.htm>

FAO (1990) Irrigation Water Management: Training Manual No. 5 - Irrigation Methods  
<http://www.fao.org/docrep/S8684E/S8684E00.htm>

FAO (1992). Wastewater treatment and use in agriculture. Irrigation and Drainage Paper 47.  
<http://www.fao.org/docrep/T0551E/T0551E00.htm>

FAO (1997). Quality Control of Wastewater for Irrigated Crop Production. Water Reports 10.  
<http://www.fao.org/docrep/W5367E/W5367E00.htm>

G. D. Rose (1999). Community-Based Technologies for Domestic Wastewater Treatment and Reuse: options for urban agriculture. CFP Report Series Report 27.  
<http://www.p2pays.org/ref/03/02008.htm>

UNEP (2000). Sourcebook of Alternative Technologies for Freshwater Augmentation". IETC Technical Publication Series No. 8.  
<http://www.unep.or.jp/ietc/Publications/TechPublications/TechPub-8a/index.asp>

Orwin, A. (1999). The Privatization of Water and Wastewater Utilities: an International Survey.  
<http://www.environmentprobe.org/enviroprobe/pubs/ev542.html>

WHO (1989) Guidelines for the Safe Use of Wastewater and Excreta in Agriculture and Aquaculture: Measures for Public Health Protection  
[http://www.who.int/environmental\\_information/Information\\_resources/documents/wastreus.pdf](http://www.who.int/environmental_information/Information_resources/documents/wastreus.pdf)

## SUSTAINABLE SOIL FERTILITY MANAGEMENT

Composting, mulching, tillage, irrigation, crop rotations, mixed cropping systems are common practices in sustainable soil fertility management.

### Manure is a Good Source of Humus

Manure is are a good source of humus or organic matter for yard and garden soils. It also provide some nutrients if there is not too much litter (straw, sawdust, or shavings) mixed in, and if it has not been stored outdoors where heavy rains wash out the nutrients. Poultry or rabbit droppings, taken from beneath roosts or hutches, are high in nitrogen. They may actually burn plant roots if used too generously. It is important to ensure adequate treatment of the manure fertilizers to avoid contamination of the fresh produce.

much it has been diluted or leached by water and the proportion of bedding, such as straw, sawdust, or shavings, that is mixed in undiluted manure.



**MARKET WASTE IN THE DOMINICAN REPUBLIC** (Photo Drescher)

Organic market wastes can readily be used as animal feed as for example practiced in Mexico City

<i>Average Nutrient Content Table</i>			
Livestock	Nitrogen	Phosphorus	Potassium
Poultry	20	14	9
Cow	8	4	6
Hog	10	7	7
Steer	10	6	8

Source:  
<http://gardening.wsu.edu/library/lanb003/lanb003.htm>

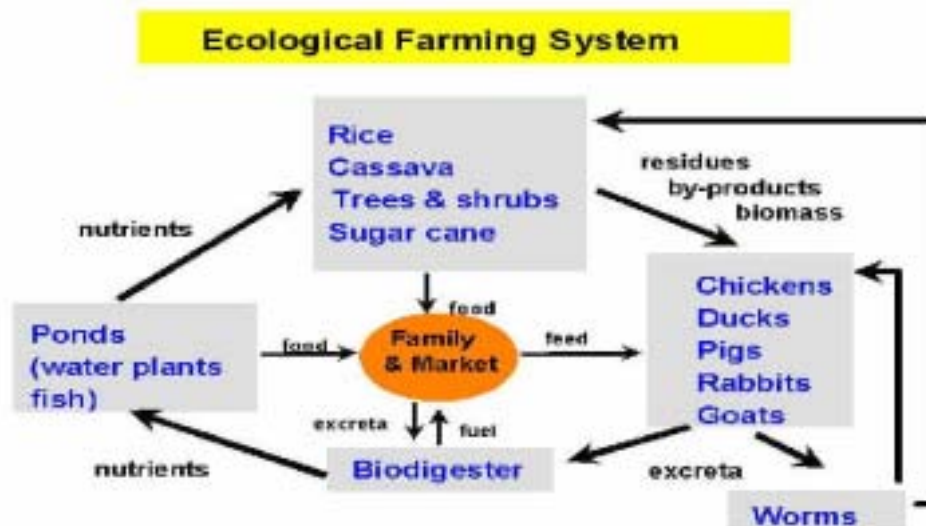
This table is based on the average nutrient content in one yard of undiluted animal and poultry excrement. Divide these numbers by 40 to estimate the nutrient content per 5-gallon bucket of fresh, undiluted manure. The value of manure as fertilizer depends on how

### Composting Recycles Plant Refuse

Composting is the biological breakdown of organic matter. Composts are a good source of humus and a good way to recycle plant refuse from the yard or garden. However, backyard composting may not kill weed seeds, disease organisms, or underground stems or roots of specific weeds. Do not put diseased plant materials in your compost. Fruit and vegetable wastes are good compost materials, but do not compost meat and fatty food. You may dig organic materials directly into fallow (unplanted) areas of your garden. This is a good way to improve your soil using food wastes.

In SE Asia, the integration of crops and livestock, and the use of manure as fertilizer, are traditional practices and are the basis of the farming systems, especially at small-holder level.

An online available FAO manual prepared by Preston and Rodriguez (1999), describes ways in which these systems can be made more efficient, more productive and more environmentally friendly, by applying simple, low-cost technologies for recycling the manure through bio digesters, duckweed ponds and earthworms. It is online available at : <http://www.fao.org/livestock/agap/frg/recycle/default.htm>



Source: FAO 1999

## Vermiculture

Earthworms can be raised in heaps of manure on the surface of the ground. At family level, where scavenging chickens are the norm, the beds must be protected. A hole in the ground about 1x1 m area and 30 cm deep is one alternative. Once the manure and earthworms are introduced the hole is covered to keep out the chickens. When the process is completed the cover is removed so that the chickens themselves "harvest" the worms



**VERMICULTURE USING GOAT MANURE**

(Source: FAO  
<http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGA/AGAP/FRG/Recycle/Earthwm/maworm.htm#Earthworms>)

## Further Reading:

Preston & Rodriguez (1999). Recycling Livestock Wastes  
<http://www.fao.org/livestock/agap/frg/recycle/default.htm>

## BOX 5: ORGANIC MANAGEMENT PRACTICES

Urban agriculture, because of its proximity to human settlements, needs careful management of natural resources even more than peri-urban agriculture. Organic farming practices guarantee long term sustainability and environmental protection.

### Main pillars of organic farming are:

- J · Sustainable soil conservation and management practices
- J · Alternative Pest Management practices, without using chemical pesticides
- J · Alternative Post-harvest practices

### Soil management practices include :

##Increasing humus content and biological activity as well as meeting mineral deficiency of soils for example through the application of rock dust, manure, crop and agro-industry residues, household waste or compost.

### Pest management practices include:

##manipulation of crop rotations, to minimize survival of crop-specific pests (in the form of, for example, insect eggs, fungi) which can infest the next crop; strip cropping, to moderate spreading of pests over large areas; manipulation of planting dates, to plant at a time most optimal for the crop, or least beneficial for the pest; biological control methods, to encourage natural enemies of pests by providing habitat (for example hedges) or by breeding and releasing them in areas where they are required; biological pesticides (for example, derris dust, pyrethrum, rotenone, neem) or other local known biological pesticides.

### Post-harvest practices include:

##in temperate countries, grains can be well conserved when harvested and stocked in conditions which allow air circulation (in jute sacs, ventilated silos, etc.);  
##traditional procedures allow conservation and enhancement of the nutritional value of cereals and leguminous

### Further Reading on Organic Farming Practices:

FAO (1998). Evaluating the potential contribution of organic agriculture to sustainability goals (FAO) <http://www.fao.org/sd/epdirect/EPre0055.htm>

Sullivan, P. (1999). Sustainable Soil Management. ATTRA. <http://www.attra.org/attra-pub/soilmgt.html#abstract>. Web page

van der Blik, J. 1992. Urban agriculture: possibilities for ecological agriculture in urban environments as a strategy for sustainable cities. Leusden, ETC.



## BOX 6 INTEGRATED PEST MANAGEMENT (IPM)



### CUBA'S EXTENSION FOR URBAN FARMERS

The government also encourages gardeners through an extensive support system including extension agents and horticultural groups that offer assistance and advice. Many gardeners were inexperienced in the type of small-scale, organic cultivation necessary for urban production. The extension services helped to educate gardeners and spread the word about new biologically based pesticides and fertilizers and agroecological techniques. Seed houses throughout the city sell seeds, gardening tools, compost, and distribute bio-fertilizers and other biological control agents to small farmers at very reasonable rates.

New biological products and organic gardening techniques are developed and produced by Cuba's agricultural research sector, which had already begun exploring organic alternatives to chemical controls. This emphasis on alternative methods of pest and disease control has enabled Cuba's urban farms to become completely organic. In fact, a new ordinance prohibits the use of any pesticides for agricultural purposes anywhere within city limits.

*Food First 1999*

### IPM Field

Schools are forums for community action. Farmers who live in a village share both its ecological location and a social and political community. IPM Farmers' Field Schools are forums where farmers and trainers debate observations.

They apply their previous experiences and present new information from outside the community; the results of the meetings are management decisions on what action to take.

Thus, IPM is a dynamic process that is practised and controlled by farmers. It is not a passively adopted product or technology. IPM training assists farmers to transform their observations to create a more scientific understanding of the rice agro-ecosystem.

The discovery-based learning process reduces farmers' dependence on outside technology and increases their self-reliance, strengthens indigenous investigations that farmers have carried out through

millennia and makes them more active, stronger partners who can make the research and extension system responsive to local needs and priorities. Farmers' Field Schools often take root in pre-existing farmers' organizations and help them work better. IPM Farmers' Field Schools catalyse these groups to focus on concrete goals: the rice crop and more sustainable production. The IPM training process shows how to build better stronger groups from the individual insights and accomplishments of members.

Trainers are often embedded in extension systems that emphasize the delivery of fixed messages and physical and financial inputs from a central source. For IPM training, however, they must become skilled facilitators of groups; this means that the training of trainers, which is much more intensive for IPM than normal agricultural extension, includes group dynamics and group strengthening.

*Source: FAO 1994*

## POLLUTION TO THE ENVIRONMENT

There are many health and environmental risks associated with UPA. Both animal and plant waste can cause serious problems in towns and cities. The closeness of livestock to large numbers of people increases the risks of disease transmission from animals to humans.

Soils and/or water in urban and peri-urban areas of developing countries are often contaminated. Problems arise when food crops are grown on soils contaminated with heavy metals and other toxic materials and irrigated with polluted water.

In the area of health and environment, extension services can play a significant role in helping food producers and those involved in processing and marketing help protect the public against unsafe and unhealthy food. Strategic extension campaigns can also help inform the general public about the health and environmental risks associated with UPA.

In cities there is a reduced environmental capacity for air pollution absorption (e.g. carbon dioxide and methane from organic matter, ammonia, nitrous oxide and nitrogen oxide from nitrates).

Without appropriate management and monitoring of resources, negative environmental and health effects of UPA can be imposed on society.



The contribution of UPA to the citizens is dependent upon the advantage taken from the opportunities and an awareness of how the risks can be monitored and controlled. In places where farm to market systems are inadequate, UPA fill critical gaps. Manure and its effluent require an appropriate treatment for recycling and use in horticulture production.



### ORGANIC WASTE COLLECTION IN HYDERABAD

Source: <http://indiaa.com/exnora/swm.html>

Optimal management of urban and peri-urban resources requires land use planning which views agriculture as an integral component of the urban natural resources system and balances the competition of the natural resources (water, land, air, wastes) among the users.

Benefits include improved hydrological functioning through soil and water conservation, microclimate improvements, avoided costs of disposal of the recycled urban wastes (wastewater and solid waste), improved biodiversity, and greater recreational and aesthetic values of green space.

A case Study on waste management in India:

EXNORA INTERNATIONAL Solid Waste

Management. <http://indiaa.com/exnora/swm.html>

## SPECIFIC PROBLEMS WITH ANIMAL PRODUCTION

There is a wide range of evidence that many human diseases can be transmitted from livestock to people during production, processing or consumption. Major diseases include bovine tuberculosis, brucellosis, salmonella. The closeness of human beings to animals in urban areas might facilitate the spread of diseases.



### SMALL LIVESTOCK KEEPING

Ducks at the South Suburb Beijing Company, which raises the "Beijing Duck" - famous worldwide for its special taste.

1. Animal products (like red meat, poultry meat and eggs) may be contaminated with pesticides (especially organo-phosphates) and/or antibiotics, if animals kept in an intensive system
2. Animal products may become contaminated by heavy metals if animal feed and/or drinking water was polluted by industry or traffic
3. Free wandering animals can injure people and may cause traffic accidents
4. Allergens from livestock wastes/dust (esp. poultry) can cause occupational diseases in farm workers (asthma, allergic pneumosis)
5. Tanneries may discharge hazardous chemicals in their wastes (tannum, chromium, aluminium)

Although, generally speaking, the keepers of large livestock and those of small livestock were rather unanimous regarding the various problems, there are some problems which are more

specific to large than to small livestock and vice versa.

Lack of feed and safe drinking water is much more a problem for large livestock keepers, probably simply because these animals eat and drink much more than small animals. Harassment, though not frequently mentioned, is also a constraint specific to large livestock. This may be related to the regulation which says that it is forbidden to let large animals freely roaming around.

**Further Reading:** Smith O.B. & E.A. Olaloku (1998). PERI-URBAN LIVESTOCK PRODUCTIONS SYSTEMS Cities Feeding People, CFP REPORT SERIES Report 24 [http://www.idrc.ca/cfp/rep24\\_e.html](http://www.idrc.ca/cfp/rep24_e.html)



## CONTACT POINTS

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*Annex I: City and location of main agricultural activities - farming systems information*

City	Urban Area	Peri-urban Area	Average Farm (Plot) Size	Gender Specifics
<b>Africa</b>				
<b>Accra (Ghana)</b>	Food crops, home gardens: vegetables, poultry Open spaces: crops, vegetables	Crop farming, mixed farming	No data	PU <sup>3</sup> : Men (vegetables) U <sup>6</sup> : Men (crops) Women (small livestock) U: Women PU:
<b>Nairobi (Kenya)</b>	Home gardens, vegetables, poultry Open spaces	Market farms, crops, poultry, livestock	No data	U: Women PU:
<b>Dakar (Senegal)</b>	Home gardens: vegetables Small scale livestock (poultry, sheep)	Vegetables, battery chicken, laying hens	U: 10-30 m <sup>2</sup> PU: 0,1 - 1,0 ha (small-scale); 1 - 20 ha (market)	PU: Men U: Women (98% home gardens) and men
<b>Dar es Salaam (Tanzania)</b>	Home gardens, community gardens, small-scale livestock Open space: vegetables	Vegetables, mixed crop-livestock system fruit production	PU: 2 ha U: few m <sup>2</sup> to some 100 m <sup>2</sup> (Home gardens) U: 700-950 m <sup>2</sup> (open spaces)	PU: Men and Women U home gardens: Women U open spaces: Men and women
<b>Kampala (Uganda)</b>	Open spaces: crops, vegetables, poultry		PU: 1200 m <sup>2</sup> U: 100 - 400 m <sup>2</sup>	U: Women
<b>Lusaka (Zambia)</b>	Home gardens, small scale livestock Open space: crops and vegetables (rainy season)	Vegetables and crops, livestock	PU: 830 m <sup>2</sup> (small scale) U: 120 m <sup>2</sup> (gardens, high density); open space: 420 m <sup>2</sup>	PU and open spaces: Men U: home gardens: Women
<b>Harare (Zimbabwe)</b>	Home gardens, vegetables, small livestock Open space: crops (rainy season)	Market horticulture vegetables, crops, livestock	PU: 430 m <sup>2</sup> U: 30 m <sup>2</sup> - 300 m <sup>2</sup> (high density - low density))	PU: Men (large scale market) Women (small scale market) U: Women
<b>Europe</b>				
<b>Sofia (Bulgaria)</b>	Home gardens , vegetables Private commercial farms	Crops, livestock (private)	U: 1000 - 10 000 m <sup>2</sup>	U: Women
<b>Latin America</b>				
<b>San Jose (Costa Rica)<sup>1)</sup></b>	Home gardens: vegetables	Vegetables	U: 20 - 100 m <sup>2</sup> PU: 100 - 2700 m <sup>2</sup>	U: 90% women (home gardens)
<b>Havana (Cuba)</b>	Community orchards, organoponics: vegetables, spices, medicinal plants	Organoponics, poultry, fruits,	U: 1200 m <sup>22</sup> PU:	U and PU: men and women

Continued ANNEX I: Latin America			
City	Urban Area	Peri-urban Area	Average Farm (Plot) Size
			Gender Specifics
<b>Latin America</b>			
<b>Santiago (Dominican Republic)</b> <sup>2)</sup>	Solares (plots): food crops, tobacco, small scale livestock Home gardens: vegetables	Food crops, tobacco, livestock	U: 200-600 m <sup>2</sup> PU : ca. 2 ha
<b>Port-au-Prince (Haiti)</b> <sup>3)</sup>	Home gardens: Ornamentals, vegetables, medicinal plants crops, trees	Open spaces: crops, vegetables, trees, ornamentals,	U: 5 m <sup>2</sup> - 1 ha PU: 100 m <sup>2</sup> - 25 ha and more
<b>Mexico City (Mexico)</b> <sup>4)</sup>	Home gardens, <i>parcelas familiares</i> , <i>solares</i> : vegetables, flowers, fruits Roof production Pigs	Grain, vegetables, forage, sheep, pig and poultry	Intensive use: 800-1000 m <sup>2</sup> Extensive use: 0,5-2 ha
<b>Lima (Peru)</b>	Home gardens, community gardens	Vegetables, tubers, trees, hydroponics, herbs, medicinal plants, livestock (PU)	U: 60 - 200 m <sup>2</sup>
<b>Asia</b>			
<b>Hubli-Dharward (India)</b>	Vegetables, small livestock	Livestock, vegetables, sewage based Farming System	PU: 6000 - 8000 m <sup>2</sup>
<b>Vientiane City (Laos)</b>	No information	Vegetables,	PU: 5000 m <sup>2</sup>
<b>Manila (Philippines)</b>	Vegetables, fish, poultry	Rice	no information
<b>Cagayan de Oro (Philippines)</b>	40 % home gardens/ fish production	Crops and vegetables/ fish production	PU: 1,7 ha, 0,5 ha for vegetables
<b>Ho Chi Minh City (Vietnam)</b>	No information	Crops, vegetables, sugarcane, rubber, gardens, orchards	no information

1) Information on San Jose (Costa Rica) from C. H. Marulanda (personal communication), according to this source, the situation in other major cities of the area, like Managua (Nicaragua), Guatemala (Guatemala), San Salvador (El Salvador) and Bogotá (Colombia) is very similar with respect to sizes of the home gardens and the high involvement of women in vegetable production.

2) Information for Santiago (Dominican Republic) from J. P. del Rosario (personal communication)

3) Information for Port au Prince from M. Regis (personal communication)

4) Information for Mexico City from B. Canabal (personal communication)

5) PU: Peri-Urban

6) U: Urban

Source: Jacobi, Drescher & Amend (2000)

*ANNEX II: Population growth, informal employment and poverty in selected countries of Africa, Latin America and Asia*

Country	Urban Population (in 1000)			Population Growth Rate (percent)						Informal Employment (percent) 1993	Poor Households (percent)		Poor Households (Female Headed) (percent) 1993
	1980	2000	2020	Urban		Rural		2020-25	1993		1993		
				1980-85	2000-05	2020-25	1980-85					2000-05	
<b>Africa</b>													
Angola	1,467	4,371	10,697	5,6	4,9	3,8	1,9	2,0	1,2	36	36	41	
Botswana	137	1,191	2,142	13,7	4,2	1,6	0,9	-5,5	0,2	45	55	40	
D.R.Congo	7,756	15,67	39,648	2,7	4,5	4,1	3,4	2,3	1,4	50	48	80	
Egypt	19,178	31,297	51,098	2,6	2,6	2,1	2,6	1,0	-0,2	x	43	x	
Ghana	3,368	7,644	16,742	4,2	4,2	3,2	3,1	1,7	0,7	70	25	x	
Kenya	2,673	10,043	22,468	7,7	5	3,4	2,0	1,3	0,8	52	27	25	
Lesotho	183	641	1,544	6,8	5,1	3,4	2,0	1,3	0,8	31	49	59	
Malawi	565	1,686	4,657	5,8	5,2	4,5	2,9	2,0	1,4	51	66	x	
Nigeria	19,353	56,651	124,888	5,5	4,6	3,0	1,8	1,2	0,8	77	62	67	
Senegal	1,988	4,463	9,09	3,9	4	2,8	2,2	1,3	0,6	47	13	x	
South Africa	14,043	23,291	39,548	2,6	2,7	2,2	2,4	1,5	0,0	x	x	x	
Tanzania	2,741	9,376	23,354	6,7	5,2	3,7	2,5	1,7	1,0	x	23	x	
Togo	599	1,556	3,589	5,9	4,3	3,6	2,0	1,8	1,0	27	12	x	
Uganda	1,154	3,18	9,333	4,8	5,5	4,8	2,1	2,5	1,7	46	77	36	
Zambia	2,285	4,067	8,019	2,8	3,3	2,9	1,8	1,8	0,6	x	17	69	
Zimbabwe	1,587	4,387	8,928	5,8	4,1	2,5	2,5	1,0	0,0	17	x	x	
<b>Europe</b>													
Bulgaria	5,42	5,82	5,867	1,3	0,0	-0,1	-1,6	-1,7	-1,8	12	x		
<b>America</b>													
Costa Rica	985	1,97	3,308	3,7	2,9	2,0	2,3	0,7	-0,1	x	24*		
Cuba	6,613	8,727	9,838	1,7	0,8	0,3	-1,1	-1,4	-1,2	x	x	x	
Haiti	1,269	2,727	5,471	3,7	3,6	3,1	1,2	0,8	0,6	x	65*		
Dominican Rep.	2,877	5,537	8,013	3,8	2,3	1,2	0,5	-0,3	-0,6	x	45*		
Mexico	44,832	73,553	99,069	3,2	1,7	1,2	0,2	0,6	-0,5	x	23*		
Brazil	80,589	137,527	182,139	3,4	1,7	0,9	-0,7	-1,4	-0,6	36	19	22	
Peru	11,187	18,674	26,778	3,1	2,1	1,4	1,0	0,2	-0,3	49	29	7	
<b>Asia</b>													
China	195,908	438,236	711,698	4,2	2,9	1,7	0,6	-0,6	-0,8	x	9* total Popul.	x	
India	158,851	186,323	498,777	3,2	2,9	2,5	1,8	0,9	-0,2	67	17	14	
Laos	429	1,336	3,361	5,4	5,2	3,5	1,8	2,0	0,7	x	24	x	
Philippines	18,11	43,985	69,862	5,2	3,1	1,6	0,6	-0,1	-0,4	20	13	9	
Vietnam	10,338	15,891	28,439	2,5	2,4	3,3	2,1	1,3	0,2	x	51	x	

Source: World Resource Institute 1998-1999, p 274 ff. \*Data for 1980-1990 by World Resource Institute 1996-1997, p 150 ff., x = no data available

Source: Jacobi, Drescher & Amend (2000)



## ANNEX III: Integrated wetland systems (IWS)

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*Excerpt from: Sewage and Sunshine – India 14 March, 2000*

<http://info.tve.org/ho/doc.cfm?aid=572> TVE Television Trust for the Environment

Wetlands in urban areas are natural receptacles for wastewater because they harness the nutrients available in waste through fisheries and agriculture. The integrated wetland system project aims to provide a low-cost, ecologically balanced and community linked sanitation option for the poorer cities of the world with ample sunshine. It is a system that frees the river from domestic contaminants and can at the same time recover the wastewater nutrients with remarkable efficiency to grow fish. The system costs less than other technologies for treating sewage and recycling waste.

There are two types of IWS - the *flow-through system* and the *abstracted flow system*. The primary objective of the *flow-through system* is the treatment of wastewater and for the *abstracted flow system*, it is resource recovery.

In the *flow-through system*, the entire wastewater is transported through a pre-treatment system and is then detained in the recycling ponds for further treatment and for growing fish. Subsequently, the effluent from the recycling ponds is used for irrigation in downstream areas. The *flow-through system* needs less land to ensure adequate wastewater treatment and is particularly effective where cost of land is high.

The *flow-through system* can be divided into two types: minimum area or low cost system and large area system. In the minimum area system, the emphasis is on wastewater treatment and the area varies according to the effluent quality requirements. The large area system emphasises the need for aquaculture and requires an area three or four times that of the minimum area system.

In the *abstracted flow system* wastewater is abstracted from the outfall channel or receptacle stream and is used for growing fish or for irrigation, or both. In this case, the user can draw the wastewater as and when required.

### **Initial steps for implementing IWS projects**

**Evaluating wastewater loading:** most of the subsequent steps depend on the volume of liquid which the system is expected to handle. It is also essential to identify the existing drainage system through which the effluent will finally flow down.

**Local resistance to aquaculture** will have to be identified before starting any project planning. Fish farmers are able to earn reasonable profit by selling fish to other markets so there is a tendency for fish to be harvested even where they are not locally consumed.

**Ascertaining outfall direction:** once appropriate project sites have been identified, it is necessary to carry out a base line survey, including hydraulic, soil, topographical and land use surveys.

**Land acquisition formalities** need to be completed in a legally valid manner appropriate to the country and place of the IWS.

**Detailed project design:** there needs to be an efficient programme of operation and maintenance support and the sustainability of the project should be protected against engineering and economic risks by safeguarding the constructions, facilitating stakeholders participation and upgrading the resource recovery system.

### **Major components of IWS**

- ⌘ **Wastewater collection** from cities through a sewerage system up to the IWS project site.
- ⌘ **Pumping** of wastewater to lift it from below the ground and carry it up to the IWS project site, occasionally through a force main.
- ⌘ **Pre-treatment** of wastewater to ensure safe aquaculture in recycling ponds.
- ⌘ **Primary recycling ponds** are mixed flow reactors where the functions of nutrient removal and treatment of wastewater take place simultaneously.
- ⌘ **Secondary recycling ponds** are the waterbodies within any user region which recycle effluent from primary recycling ponds and are used for growing fish or other commercial aquatic crops.
- ⌘ **Effluent irrigation in user regions** that takes place on the downstream side of the outfall channel can be used for generating crops and planting trees. Fish can be cultured in ponds using the effluent. Linking user regions with the effluent channels will enhance the food security amongst the beneficiary communities and ensure larger participation of the stakeholders in IWS projects.

### **Site selection**

Issues to be considered during the selection of the project site will include:

- ⌘ Amount of wastewater loading
- ⌘ Quality of wastewater discharged
- ⌘ Location of the terminal pumping station
- ⌘ Location of potential user regions
- ⌘ Location of the receptacle channel
- ⌘ Area of the project site, cost of land and status
- ⌘ Present land use of the project site
- ⌘ Land use of the area adjoining the project site
- ⌘ Lay of the land and relative relief of the project site
- ⌘ Whether or not the site is being considered for any other development project

### **Estimating wastewater loading**

The quantity of waste to be treated is an important criterion for designing IWS. For estimating the quantity of wastewater it is necessary to consider:

- ⊘ Per capita water consumption
- ⊘ Existing population
- ⊘ Future growth of population
- ⊘ Industrial waste discharge
- ⊘ Infiltration into the sewers

The total amount of water supply should contribute to the total flow in a sanitary sewer except for a small portion which is lost through evaporation, seepage and leakage etc.

### **IWS in operation**

The technique of using shallow wastewater ponds for recycling urban discharge is straightforward. The flow of wastewater into the shallow ponds is controlled and it is left in the ponds for up to ten days. During this time, light penetrates the water and reacts with the waste to create an environment rich in algae and plankton which is ideal for fish to feed on and grow in. The selection of fish species suitable for wastewater ponds needs to be carefully considered and there are specific criteria that should be met.

Maintenance is minimal but in order for the small fish to thrive, the water needs to be churned up and snails, which eat the algae, need to be picked out of the pond. Water hyacinth is used to stop the banks from eroding, but also needs to be kept under control. The biggest menace is from fish thieves so at night groups of men guard the ponds.

As well as the sewage being treated, the fish farmers are averaging yields of 10,000 tonnes of fish each year. The fish contain fewer pathogens than most other fish in the market and so are perfectly safe to eat. However, it is important to make sure that no industrial waste finds its way into the sewage canals. The "clean" water can be used for irrigation on the vegetable gardens nearby. Although pisciculture is the mainstay of IWS projects, planting trees and growing crops, vegetables and flowers ensures economic and ecological sustainability.

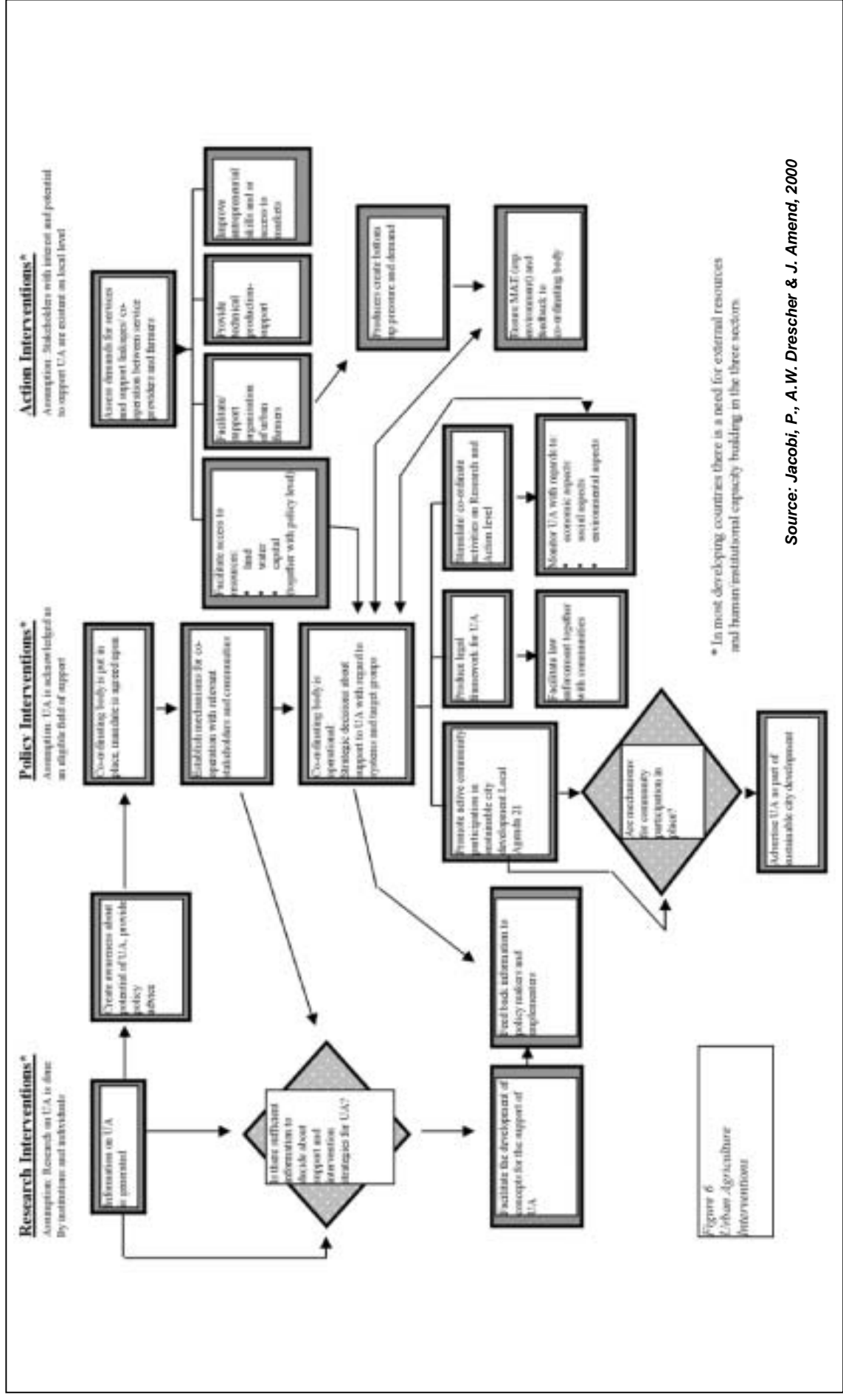
### **Advantages of IWS**

In many cities in developing countries, the wetlands or natural depressions accumulate wastewater and become sources of health risk for humans. However, the planned use of these receptacles can change the waterlogged areas into sustainable technology for wastewater treatment and resource recovery. The following are advantages of such a wetland system:

- ⊘ **Reduced consumption of conventional energy** – IWS is basically a solar reactor and completes most of its biochemical reaction with the help of the sun.
- ⊘ **IWS is a flexible system** and can work with almost no-flow condition to full-flow condition with uniform proficiency and only minor adjustments.
- ⊘ **More efficient removal of pathogens** – conventional mechanical sewage treatment plants are largely ineffective in removing pathogens whereas IWS can ensure a reasonable reduction because of the detention time it allows to the incoming wastewater.

- ⌘ **Enhancing food security** – IWS includes pisciculture, horticulture and animal husbandry all of which have a common and rich nutrient base that is drawn from municipal wastewater.
- ⌘ **Contributes to rural development** – completion of IWS projects triggers a chain of economic activities by providing enriched irrigation water in addition to the piscicultural units which form part of the system.
- ⌘ **Institutionalises participation of stakeholders** – participation of the local people at all major levels of planning construction and maintenance is a basic need for successful running of the system.
- ⌘ **Longer life-span of the treatment facility** – conventional sewage treatment plants are prone to damage and frequent breakdowns with a huge financial liability accruing in order to properly maintain such treatment plants. IWS is a revenue earner and proper management will not only make it self reliant but profitable. Furthermore, being a non- structural option, the problem of damage and breakdown hardly ever arises and the system can continue to work for any length of time without any major system disorder.
- ⌘ **Minimum construction time** – IWS projects can be completed within 18 months compared to 5 years for a conventional sewage treatment plant

# ANNEX IV: Planning for Urban Agriculture: Research, Policy and Action



Source: Jacobi, P., A.W. Drescher & J. Amend, 2000