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Urban Agriculture

Food, Jobs and Sustainable Cities

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Urban Agriculture

Food, Jobs and Sustainable Cities



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Cover photo: Cultivation in downtown Nairobi by The Urban Agriculture Network.

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* From the collection of Urban Resources Systems,
Patricia Goudvis, photographer.

+ From the collection of Urban Resources Systems.

From the collection of the American Community Gardening
Association.

All other photos from the collection of The Urban Agriculture Network.

Introduction to the series

The trend, now well known, is irreversible: the number of people living in cities will more than double in 35 years. In 1990 the world's urban population stood at 2.4 billion. In 2025 it is expected to reach 5.5 billion, a trend accelerating in developing countries, whose share of the total will rise from 63% in 1990 to 80% in 2025.

At the same time, it is clear that past incentives to keep the developing world's people in rural areas—on the theory that growth of cities led only to unemployment—have not worked. The rural-versus-urban development model has not been successful, because people want to go where the jobs are, and jobs are seen to exist in cities. Thus, it is necessary to help people help themselves to a better life—wherever they are.

There lies an enormous challenge—to prepare the cities and the settlements around them not merely to absorb this population but to assist in finding or creating livelihoods, social services, adequate shelter and an environment in which they can flourish. It is a challenge that will be faced by the second United Nations Conference on Human Settlements—Habitat II—in June 1996. This series, developed for Habitat II, will help those people preparing for the conference, those attending it and those working to follow up on Conference commitments with action around the world.

The United Nations Development Programme (UNDP), working closely with the Conference leadership, has produced this series of books. UNDP has a history of working in urban settings and is strongly committed to the goals of Habitat II as goals that fit into UNDP's vision of sustainable human development. That development not only generates growth—it distributes the benefits equitably.

It regenerates the environment rather than destroy it. It empowers people rather than marginalizes them. It gives priority to the poor, enlarging their choices and providing for their participation in decisions that affect their lives. And that development is pro-city because it is pro-poor, pro-nature, pro-jobs and pro-women.

UNDP also published in 1991 a strategy paper on urban development cooperation, "Cities, People and Poverty", followed in 1992 by a policy paper on the urban environment. The two papers provided guidelines not only for UNDP but for the UN system.

This new series builds on past publications and provides direct support to UNDP's "Action Package" for Habitat II, with various national, regional and global activities. That package calls for UNDP to work with UN system partners in each developing country to help countries prepare for the Conference and its follow-up by reviewing past policies, selecting best practices for replication, and preparing national urban action plans. UNDP organized, among various other activities, regional workshops in Accra, Amman, Bangkok, Katmandu, Quito, and Warsaw to build local partnerships with NGOs and others to promote urban development. UNDP called an International Colloquium of Mayors in 1994, beginning a round of activities to strengthen cities' ability to serve their residents' needs.

This series focuses on practical issues—on urban agriculture and sustainable livelihoods, rural-urban linkages, approaches to participatory local governance, gender equality, the role of the informal sector, employment generation and building the capacity of those who administer the cities of the world.

At this point, solid information built on realism and experience is needed more than theory. These books provide such information and guidance. I commend my colleagues at UNDP and the collaborating institutions and agencies for producing this series. I urge our country offices to continue to work closely with the people in each country to make urban life productive and sustainable.

James Gustave Speth
Administrator
United Nations Development Programme

Foreword

This book has four main purposes: (1) to present a comprehensive picture of urban agriculture in Asia, Africa and Latin America; (2) to define a distinct industry that needs to be recognized and treated as such; (3) to persuade leaders in government, non-governmental organizations, research institutions and other public and private entities to conduct research, support action projects and eliminate unnecessary constraints to the growth of the urban agriculture industry and (4) to foster a climate that empowers practitioners and the agencies that back them to fulfill the industry's potential for improving public well-being and the quality of urban life.

The book reveals that urban agriculture has been overlooked, underestimated and underreported. It outlines the historical prejudices and biases against urban farming, which for the most part are either unfounded or obsolete. Actual problems that can result from ill-practised cultivation and animal rearing in urbanized areas are identified, as are the many benefits of well-planned and well-executed urban agriculture.

Additionally, the volume reviews the history and current status of urban farming in terms of its relevance for the future, describes some of the urban agricultural enterprises that exist in a score of countries and explores potential methods of promoting the urban agriculture industry.

Through extensive interviews and correspondence, it has become clear that urban agriculture has been underrated in all but a handful of countries—and mostly overlooked by the international development community. During the 1980s, the industry was in a period

of rapid growth, which included a transfer of methods, particularly from Asia to Africa and Latin America. Nutritionists, energy specialists, geographers, urban planners, agriculturists and social scientists began to report on this growth at an unprecedented rate, each from their own point of view. This book is, we believe, the first effort to pull together their findings. We therefore consider it to be a “wake-up call”.

As an industry, urban agriculture is closely linked to several urban, ecological, social and economic systems. It provides economic benefits for urban farmers and their communities and cities. It enhances the living environment and can improve efficiency in urban management. It contributes to better public health (if practised properly) and furthers social participation in the community. It can play an important role in reducing some types of hazards and in aiding the survivors of others.

Because of these multiple linkages and benefits, urban agriculture—more than most other industries—requires partnerships between public and private interests to achieve its potential. Yet urban farmers by and large believe that they are isolated pioneers without support. They have difficulty accomplishing what other industries consider routine, such as buying necessary inputs (seeds, fertilizer and tools), borrowing capital or buying insurance, acquiring a manual or obtaining instructions on how to produce a new product or crop or even protecting their activities against theft. Through solidarity and dissemination of knowledge, urban farmers should have a more secure foundation that ensures better returns for their efforts.

Study approach and audience

This volume focuses on urban agriculture in Asia, Africa and Latin America, particularly on cities visited by UNDP consultants from The Urban Agriculture Network during four study trips in 1991 and 1992, and on subsequent tours of other cities. It makes only occasional references to urban agriculture in Europe, the Middle East, the Pacific islands, the Caribbean and North America. This was a decision made at the outset because it was foreseen that the greatest potential benefits could be realized in the developing regions represented by the countries visited. However, the findings and conclusions of this document do refer to reports on other geographic areas where the information is available. It is important to note that some wealthy

countries, including Japan and the Netherlands, have long been leaders in urban agriculture.

The intended audience for this book includes policy-makers, researchers, development agency staff, government agencies, non-governmental organizations and private organizations concerned with food security as well as those involved in agricultural production, processing and marketing; urban hunger and nutrition; microenterprise development; the urban environment and waste management. The priority audience is in the developing countries but includes international agencies and readers with related concerns in industrial countries. For instance, recent books on “green” and ecological cities have chapters on urban agriculture, and it is hoped that this book will resonate with some of their readers. There is also considerable interest in urban agriculture among the supporters of sustainable agriculture. The views expressed in this book are not necessarily shared by UNDP’s Executive Board or other member governments of the UNDP.

Background

The findings and conclusions are based on field research the organization conducted in 18 countries in Asia, Africa and Latin America during 1991 and 1992, supplemented by additional trips to several other countries, along with desk and library research that reviewed studies from the early 1970s through 1995. More than 300 interviews and more than 100 site visits were conducted with farmers, government officials and representatives of non-governmental organizations, community groups and research institutes. Important information was also obtained through visits to research and operating agencies of the United Nations and participation in workshops and conferences.

The book is thus not the work of one author or even a team, but has literally hundreds of committed authors: the members of The Urban Agriculture Network. The beginnings of the network date to early 1991, when UNDP/DGIP, with the technical support of the Urban Development Unit, launched this benchmark study of urban agriculture to provide a common base of knowledge on the issues, strengths, problems and concerns related to urban farming. By emphasizing a global field-visit approach, UNDP enabled a network to form gradually, with the study authors initially acting as its central node.

Reading and using this book

Part I of this book outlines just how significant urban agriculture is and why its processes fit into the urban food and ecological systems. It provides an overview of urban farming today and in the past, including some success stories from different regions of the globe. Part II gives a detailed characterization of urban farming—defining who the farmers are, where farming is undertaken, what crops are farmed and how, and which actors play a key role in the activity. Part III discusses the benefits of urban farming and the problems it can cause when poorly practised, as well as the constraints farmers face. Finally, part IV looks to the future to define a strategy for promoting urban farming throughout the world.

Various readers may wish to use this volume in different ways. *Leaders of development agencies* may be less interested than farmers in studying the many examples of different urban agricultural enterprises. They may, however, wish at least to scan the case studies in parts I and II, which present snapshots of particular applications. Part IV, on the other hand, is addressed to their municipal, regional and global agendas and may be of less interest to practitioners.

Certainly *farmers* know all too well the information in the chapter in part III on the constraints facing urban agriculture. This book nonetheless can provide them with useful comparative information as well as serve as a source of ideas from other countries and regions. Perhaps a sense of belonging to a global community of fellow practitioners will emerge from their reading of parts I and II.

Some *specialists* will know far more than what can be found in this book on their particular area of interest; they may, however, be able to integrate that focused knowledge into other domains with which they are less familiar. A sanitation specialist, for example, may be surprised by the significant links of waste to the urban food system.

All readers will gain from part III, which contains chapters on the benefits, problems and constraints of urban agriculture. If a consensus can be found about what can and should be done, a new urgency will be created to break the shackles that are retarding urban agriculture's development.

Concluding thoughts

As you read, keep sight of some of the broader implications of farming in the city: towns, cities and metropolises that are ecologically sustainable; an opportunity for the poor to become nutritionally self-reliant

and to supplement their income; and a thriving industry that contributes to economic development. This is the promise that farming holds for urban areas.

Some public officials, business leaders, leaders of non-governmental organizations and other key individuals may already be persuaded of the merits of urban agriculture. It is hoped that this book will help convince others as well.

*Anders Wijkman
Assistant Administrator and Director
Bureau for Policy and Programme Support
New York
January 9, 1996*

Preface

This volume is due largely to the funding, foresight, enthusiasm and leadership of the Science, Technology and Private Sector Division and the Urban Development Unit of the Management Development and Governance Division of the United Nations Development Programme.

Intellectual guidance was provided by an advisory committee drawn from private and public agencies. Members of this committee actively participated in review meetings over a two-year period (they are acknowledged in appendix A). A second round of study trips, sponsored by a number of agencies, added to the body of knowledge. (The countries and cities visited during the course of this study are listed in appendix E.)

The field work undertaken as part of this study was successful in large measure because of the vast knowledge, warm hospitality and boundless generosity of hundreds of members of an ever-expanding network. An early draft of this report was sent to 50 experts, and many of their comments significantly shaped this final version. (They, too, are credited in appendix A.)

The unofficial network was formalized in 1993 by the creation of The Urban Agriculture Network, a non-profit resource centre based in Washington, D.C. This centre has accumulated a considerable collection of books, articles, unpublished reports, bibliographies, videos and radio programmes that are available for consultation by anyone interested (appendix G offers an indication of the breadth of the collection).

However, The Urban Agriculture Network was not created merely as a resource centre. It is intended as a foundation from which a network of urban agriculture practitioners and supporters can be launched—a “network of networks”. The beginnings of regional nodes are already visible. A Latin America-wide conference has led to the launch of a network in that region; another network is sprouting in

a few countries in Africa; and a conference was held in December 1995 in South Asia, with a view towards forming a network in that region as well. The momentum towards greater recognition of this industry seems finally to be gathering.

Some clarification is appropriate. First, most chapters emphasize issues associated with the lowest-income population. This treatment is not based on any characteristics inherent to the industry. Rather, it reflects UNDP's, and the authors', special interest.

Second, the book is neither a technical how-to manual nor an academic document. It is based largely on interviews and field observations. Written sources are cited (in notes at the end of each chapter and in appendix C); however, information obtained from the first-hand sources on which much of the book is based is not similarly referenced in the notes that follow each chapter.

In the case examples, first-hand sources are referred to as "Urban Agriculture Network case file". Where possible, contacts are identified to benefit readers who wish further information. If detailed contact information is listed in appendix F (selected resource people), that provided in the case is abbreviated.

Third, because urban agriculture consists of many diverse activities, not all conclusions or summary statements are valid in all instances or all countries. Moreover, general statements cannot encompass the full scope of urban agriculture efforts. As a result, exceptions and contradictions will occasionally be found in this volume.

In addition, some examples of urban agriculture are based on secondary material. Some that existed in the 1980s may no longer exist; similarly, some former successes may no longer be thriving. Urban agriculture is often transitory. But even as one site is abandoned or reused, another is put into intensive cultivation. Participants and active organizations also come and go—again, an intrinsic characteristic of urban farming itself. Updates from readers will enable the material to be updated in a future edition.

For this purpose, and so that readers can alert us to any conclusions that may prove wrong when more data are available, a response form is provided (appendix H) to help guide next efforts.

Jac Smit
President
The Urban Agriculture Network
Washington, DC

Acronyms

AVRD	Asian Vegetable Research and Development Center
CEPIS	Centre for Sanitary Engineering and Environmental Sciences
FAO	Food and Agriculture Organization (United Nations)
GTZ	German Agency for Technical Cooperation
HUFACAM	Huertos Familiares, Aborizacion y Crianza de Animales Menores
IDRC	International Development Research Centre (Canada)
NGO	Non-governmental organization
ODA	Overseas Development Administration (United Kingdom)
SIDA	Swedish International Development Authority
UNCHS	United Nations Centre for Human Settlements
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Childrens Fund
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WHO	World Health Organization (United Nations)

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The global significance of urban agriculture

Cities that feed themselves

At first glance, the term “urban agriculture” may appear to be an oxymoron. Agriculture is considered the quintessential rural activity, and urban agriculture is often perceived as archaic, temporary and inappropriate. Some consider it marginal at best, perhaps a constructive recreational activity or an aesthetic function that helps to beautify the “ugly” city. In fact, urban agriculture is a significant economic activity, central to the lives of tens of millions of people throughout the world. It is a rapidly growing industry that is increasingly essential to the economic and nutritional security of urban residents and that has far-reaching economic, environmental and health implications.

In an urbanizing world running short of resources, the possibility that cities can depend on the ingenuity of their residents to generate food security for themselves is significant. In countries where hunger and malnutrition are predominantly urban problems, an activity that can contribute to the nutritional self-reliance of a community, city or metropolitan region is significant. In cities choking in their own waste and pollution, an industry that can use urban waste as a basic resource is significant.

Sometimes called metropolitan-intensive agriculture, urban agriculture can be 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.*

Urban agriculture contributes significantly to the socio-economic development of towns and cities throughout the world. In several economies, particularly developing ones, it is one of the largest

urban productive industries. In low-income cities, it is a prime generator of jobs.

Urban agriculture is an easy-in, easy-out entrepreneurial activity for people at different levels of income. For the poorest of the poor, it provides good access to food. For the stable poor, it provides a source of income and good-quality food at low cost. For middle-income families, it offers the possibility of savings and a return on their investment in urban property. For small and large entrepreneurs, it is a profitable business.

There is no “average urban farmer”. Frequently, the urban farmer is a woman with a family who has lived in a town or city for five or more years, grows vegetables and raises small livestock to feed her family and earns income from sales within the community. But urban farmers also include wealthy producers of specialty crops for expensive restaurants and export, agribusinesses with plantations and out-grower contracts, fishermen cooperatives, “Saturday only” part-timers who grow cassava by the roadside and market gardeners with yearly contracts with supermarkets and hotels.

Urban agriculture is a large industry consisting of many small-scale farmers and some large agribusinesses. Urban agriculture takes place on smaller tracts of land than rural farmers’ fields and on open spaces that are vacant, idle or unsuited for urban development. Although the most common site is the household plot, urban agriculture can be found throughout the metropolitan area. A large-scale operator may rent ten hectares in an industrial zone. A small-scale farmer may make a living on as little as 200 square metres. A household garden may cover 20 square metres or less.

Some typical examples of urban agriculture include:

- ▼ Fish and other aquatic products harvested from tanks, ponds, rivers, sewage lagoons and estuaries
- ▼ Horticulture on excess vacant space at large facilities principally dedicated to other activities (for example, airports, large factories)
- ▼ Rabbits, guinea pigs and chickens raised in bookshelf cages hung on walls
- ▼ Vegetables grown in hydroponic solutions on roofs, patios and stairways
- ▼ Market gardens on vacant plots, in the green wedges between urbanized corridors or along highways and railroads in peri-urban areas.

Urban farming is, perforce, intensive, making the best use of space, with a predominance of shorter-cycle, higher-value market crops. It utilizes multicropping and integrated farming techniques and makes judicious use of both horizontal and vertical space (through such techniques as chicken-coop boxes on shelves, multispecies fish ponds and container farming). Because water is expensive and usually in short supply, urban farming tends to be more conservative and efficient in its water usage than rural farming.

Urban agriculture is oriented to close-by urban markets rather than national or global markets. Proximity to the market predisposes crop selection to perishable products—urban farmers have a competitive edge over rural farmers in being able to deliver fresher produce to consumers. Urban agriculture also normally involves fewer middlemen between farmer and consumer than rural agriculture, and the transportation and storage needs of urban produce are much lower.

The potential of urban agriculture is largely untapped and undervalued. Intensive urban horticulture can yield several times as much produce per area as rural agriculture. Limited availability of resources (land and water) and inputs in urban areas has led to the development of farming techniques that require only a fraction of the water and fertilizer needed for tractor-cultivated rural farms per unit of production. Urban farming also can absorb a significant amount of urban solid and liquid waste, helping the city reduce its waste management problems and costs. And in addition to providing crops and animals for consumption or income, urban farming contributes to environmental enhancement and disaster management (for example, through the planting of trees on steep slopes or deep-rooted tall grass in floodplains).

Myths and reality

Despite all these benefits, urban agriculture is an ill-understood industry. Urban farming is often minimized as being merely “kitchen gardening” or marginalized as a leftover of rural habits. The benefits of urban farming are lost behind myths that are the products of cultural, planning and policy biases. These biases and their consequences are considered in detail in chapter 9. It is necessary, however, to identify and address the myths surrounding urban agriculture at the outset, since these myths misrepresent the significance of urban farming and hinder recognition of its potential.

Myth 1: Urban agriculture means household and community gardening.

Household and community gardening (whether for obtaining fresher food, enhancing nutritional intake, saving on food expenses, increasing income or pleasure) are important components of urban agriculture. But urban farming goes far beyond gardening, as will be seen.

Myth 2: Urban agriculture is a temporary activity.

In all cities, even the most dense, there is always idle or “sleeping” land. In some parts of the city—along roads, in unbuildable or hazard-prone areas, in yards—farming is a long-term to permanent activity since the space either cannot or should not be used for other purposes. In other places—on rented land, on plots awaiting development—farming is a shifting land use. Some urban farming is always on the march, in central plots undergoing renewal and especially on the leading edge of urban growth. With land values increasing, a farmer first increases inputs and yields per square metre and then moves his or her farming operation to another location. But the farming activity does not die; it merely adapts and moves in response to changing conditions. (Chapter 4 provides examples of transient as well as permanent urban farming and explains why both have their place in the urban land economy and landscape.)

Myth 3: Urban agriculture is a marginal activity or means of survival.

Social scientists studying low-income urban groups have documented urban agriculture’s use as a means of family food security and nutrition (see chapter 7). The contribution of urban agriculture is greatest in the poorer cities of the world, where the share of income spent by the vast low-income population on food and fuel is by far the largest household expense. Urban agriculture is also a major urban economic sector that supplies a significant percentage of the food consumed by a city and generates income and jobs, particularly for women. The sector gives economic opportunities to both small entrepreneurs and larger enterprises, not only in agricultural production but also in related input and output industries and services; it especially provides opportunities for the large numbers of part-time and low-skilled workers.

Myth 4: Urban agriculture preempts “higher” land uses and cannot pay full land rent.

This myth is patently untrue (as chapter 4 demonstrates). Urban farming utilizes land that is unused or unsuitable for other purposes, or

it makes usufruct use of land allocated for other uses, thus returning extra land rents. Most cities have a large amount of such land that can be farmed. Moreover, some urban farming activities, such as peri-urban poultry co-ops, pay competitive land rent. And many cities are located on fertile soils; food production is as appropriate a use of land as any other.

Myth 5: Urban agriculture competes with and is less efficient than rural farming.

According to this myth, urban agriculture has a negative effect on the incomes of rural farmers. But in fact urban farming thrives on products that are less suited to rural production or that might otherwise be too costly for many urban poor. By contributing to disposable urban income, it can be the basis for expanding rural agricultural exports, while simultaneously reducing some of the pressure on marginal rural lands. (The relationship to rural agriculture is addressed further in chapter 7.)

Myth 6: Urban agriculture is unhygienic.

Health problems are undoubtedly among the most serious consequences that can result from inappropriately practised urban farming (discussed at length in chapter 8). Inappropriate use of fertilizers, pesticides or untreated waste products, and farming along roadsides where crops are susceptible to automobile exhaust, can lead to food contamination. Urban farmers must take particular care because of the potential to affect large populations. But urban farming is not intrinsically unhygienic. In fact, it has the potential to improve hygiene in the city because it uses polluting waste as a production input; this can complement the other health benefits that urban farming provides to urban residents.

Myth 7: Urban agriculture causes pollution and damages the environment.

Urban farming can cause pollution of the urban soil, water and air and affect open urban areas adversely. The solution is to provide guidance and assistance to make it a safer industry for farmers, consumers and the environment. Correctly practised, urban agriculture has many more potential environmental gains than problems (see chapter 8). Farming in urban areas reduces truck traffic and the resulting air pollution, can prevent soil erosion and rebuilds urban forests. Expanding planted area can impact favorably on the urban

microclimate. Most significantly, urban agriculture is among the best, most sensible ways to dispose of much of a city's solid and liquid wastes (especially organic ones)—by transforming them into a resource. Few activities contribute as efficiently to improving the urban soil, water, air and living environment while closing the urban open-loop ecological system of resources in, wastes out.

Myth 8: Urban agriculture is unsightly and aesthetically inappropriate in the city.

Urban farming creates green spaces in the city, replacing vacant and unkempt lots and roadsides, thereby improving a city's appearance. Well-managed animal husbandry can be more attractive than tractor maintenance of urban open spaces. Urban agriculture has vast potential and capacity for waste recycling; reducing haphazard dumping of solid and liquid waste clearly improves both a city's appearance and its hygiene. Finally, the issue of relative standards cannot be ignored: if fields of corn in the countryside are beautiful, why is a plot of vegetables in the city viewed as an eyesore?

Myth 9: The "garden city" is an archaic, utopian concept that cannot be created today.

Western thought has nurtured a utopian tradition of "garden cities" at least since the Age of Enlightenment. However, this book emerges not from ancient intellectual theories, but in response to real-world, present-day observations and concerns. The cities of developing countries are becoming garden cities in a very practical way. Meanwhile, concepts of "modernity" are actually holding back agriculture by defining industry as the activity for urban areas and farming as the activity for rural areas. Planning concepts of "city beautiful" relegate farming to the position of an outdated, backward activity that is not fit for the "modern" city. This volume shows that these assumptions are wrong and that agriculture has an important and beneficial place in the contemporary city.

Despite the unquestioned acceptance of many of these myths, urban agriculture is a growing phenomenon. It is increasingly widely practised, and its efficiency is continually improving through better organization and more advanced technology. The current level of urban farming in the world can be attributed largely to the individual, unaided efforts of urban farmers. Millions of them have noted the demand in

the urban market or the food needs of their families and have taken action to meet these needs.

Though some have begun to recognize urban agriculture as a development tool, it is policy-makers, planners, government agencies, research institutions, development agencies, non-governmental organizations and other possible promoters of urban farming that have largely failed to see its potential and have frequently placed obstacles to its practice. By reporting on the positive benefits of urban farming activities across the globe, this volume should broaden acceptance of and support for urban agriculture, especially by those who are critical to its success.

Basic concepts

It is not possible to devise a single, comprehensive classification to encompass all urban agricultural activity. For this reason, the second part of this book is devoted to presenting a number of typological systems that can be applied to urban agriculture. As will be discussed, urban farming can be categorized by product, complexity of the farming system, income of the farmer, purpose of production (for example, auto-consumption, sale at market, sale to processor), type of space used, location, form of tenure, degree of permanence, organizational mode (small versus large) or number of actors involved, among other criteria. The scope and variety of urban agriculture are discussed throughout this volume. But first it is important to clarify how the words “urban” and “agriculture” are used in this book, to define both what is included in the realm of urban agriculture and what falls outside its scope.

“Urban” is used in a broad sense, to encompass the entire area in which a city’s sphere of influence (social, ecological and economic) comes to bear daily and directly on its population. An approximate definition of the extent of a city’s zone of metropolitan intensive agriculture (differentiating urban from rural agriculture) is important to gain a sense of the types of farming systems it encompasses and the contribution these provide to the city’s system of food (and other materials). As an operational rule of thumb, urban is distinguished here as the agricultural product that gets to city markets or consumers the same day it is harvested.¹

However, this distinction is not easily made. A demographically based geographic definition of the urban region is generally adequate,

but many countries do not have such a statistical definition, and cities of medium and large size are frequently divided into several municipalities that were defined long before the urban expansion since the Second World War. Moreover, where they are officially defined, metropolitan districts often cover more than the legal municipal bounds, comprising peri-urban areas with strong ties to the city; but these metropolitan areas may or may not correspond to the urban regions.²

As for “agriculture”, it too is used in its broadest sense, embracing horticulture, aquaculture, arboriculture and poultry and animal husbandry. “Agriculture”, “farming”, “cultivation” and “raising crops and animals” are used interchangeably. “Farmer” refers not just to the agriculturist whose main occupation is cultivation, but also to the part-time or recreational one.

One term used here incorporates a significant distinction, however. Food production is encompassed within “agriculture”, but “agriculture”—as used here—covers much more than just the production of food. “Agriculture” includes the generation of a number of products that are not edible by humans, for example, fuel material, wood for other uses and feed for animals (see chapter 5). Furthermore, agriculture is more than just a production process. As is made clear at the end of this chapter, the term “agriculture” also incorporates preproduction and postproduction processes, as well as waste recycling processes.

A few additional concepts deserve explanation as well (see appendix B for definitions of still other terms). A basic concept for recognizing the importance of urban agriculture is the “food-shed”. The food-shed of a city includes all the areas that supply food products to it—local, rural or foreign. The food-shed could be defined for each food group (for example, the milk-shed, the poultry-shed or the produce-shed of a city). Generally, the richer the city, the larger its food-shed. Because transportation systems are less developed in poorer cities, and residents’ food and fuel costs as a share of income are higher, the food produced within a daily food-shed becomes more important in poorer cities than in richer ones, and the food-shed itself tends to be smaller. Note that the urban food-shed encompasses more than just the urban farming region, since much food is imported from well outside that region.

“Fungible income” refers to the substitution of goods or labour for money that would have had to be earned to acquire these (or equivalent) goods. Barter, food for labour and food for land access all create fungible

income, as does growing food for family consumption (instead of buying it). The fungible income from urban agriculture is particularly important in places where a high portion of earned income (one half or more of family income) is spent on food and fuel purchases. The high fungibility of income from urban agriculture is an easily overlooked but very powerful tool in the fight against urban poverty and represents one of the activity's greatest benefits.

The legal concept of "usufruct" is also important to an understanding of the current and future practise of urban agriculture. Usufruct refers to the legal right of using and enjoying something that belongs to another, so long as the value of the good and its utility to the owner are undiminished. In urban agriculture, a usufruct grants a farmer access to the fruits of his or her labour on a public or private land or water body that he or she does not own. Usufruct arrangements were important in Roman law and are still important in many indigenous bodies of law worldwide. Much tribal law in Asia and Africa, for example, includes usufruct principles. Typically, a usufruct is given under certain guarantees of performance by the usufruct user or in return for maintenance of the good—in this case, land or water. Usufruct arrangements are a powerful resource where the land or water body is idle and could be put to productive use.

Input-output theory offers an understanding of the "throughput" of resources in an urban ecosystem—in other words, the inputs (raw materials and products) that are brought in to support a city as well as the outputs (especially wastes) that are evacuated from it. The throughput of natural resources will need to be minimized in the future for human settlements to become sustainable rather than polluting. Urban agriculture contributes to this process by reusing its waste to produce food and fuel, which reduces both the intake and the output in the resources stream, resulting in fewer resources consumed and less pollution. This makes the city more ecologically balanced, and more resourceful (both literally and figuratively).

A fundamental change is needed (and may be emerging) in the way waste is viewed globally. Waste must be regarded not as a problem to be disposed of, but as a resource for sustainable development. Metropolitan areas must be viewed not as open-loop systems, in which resources flow in and wastes flow out, but as closed-loop systems, in which wastes and resources are one and the same (see figure 7.2).

Another useful concept in discussing urban agriculture is that of the “productive landscape”. In the urban landscape, industrial and commercial areas are often considered productive, while open spaces are regarded as recreational and aesthetic, but nonproductive. Urban agriculture creates a green and aesthetic landscape that is at the same time productive. It consists of street trees bearing fruit, ponds and rivers producing fish and water vegetables, hillsides yielding fuel and formerly vacant lots growing vegetables. The landscape is then fecund and brings high returns to the cultivator or breeder.

Urban agriculture and urban systems

Urban agriculture does not exist in isolation but takes place in the context of other urban activities and systems, particularly the local economic, land use, ecological and urban management systems. It is also integrally related to the local, national and global food systems. Any plans for managing, expanding or transforming urban agriculture must take into account the interaction between the urban agriculture industry and these systems.

The role of urban agriculture in the urban land use system is detailed in chapter 4. Chapter 7 discusses how urban agriculture fits into the urban and global economies, as well as its actual and potential function within the urban waste management system. Here, the urban nutrient cycle and the urban food system are discussed briefly, followed by a view of how urban agriculture fits into each of these.

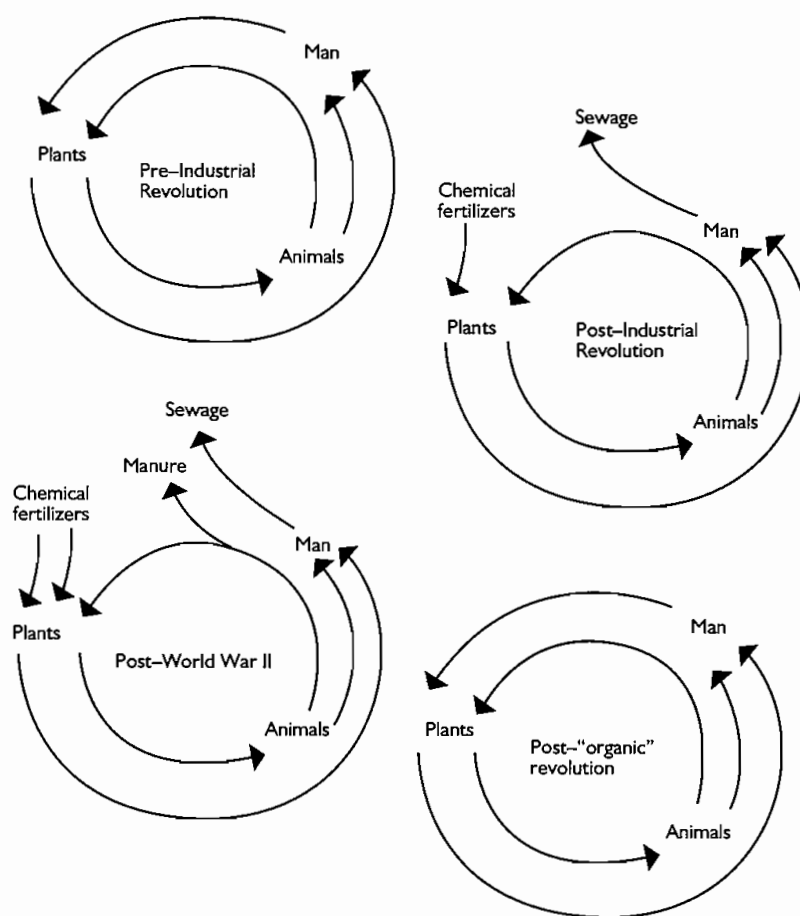
The urban nutrient cycle

Urban farming has existed throughout history and played roles both in feeding cities and in recycling urban wastes. As is shown in chapter 2, intensive horticulture, dairy and hog farms have been an intrinsic part of cities and played a vital role in their functioning since the dawn of urban settlements in Asia, Europe, the Middle East and Latin America. The preindustrial city was to a substantial degree an ecologically closed-loop system. City waste was primarily organic and suitable to regenerate the environment. The liquid and solid wastes of the city were returned to the land and served as the prime source of soil building and enrichment for the production of perishable food for the city.

With the industrialization of the last two centuries came rapid urbanization and the development of a dichotomous planning concept that created a functional separation between the “country” and the “town”, with the countryside producing food and the city industrial goods. Urban land use planning and hygiene principles discouraged urban farming. The development of large-scale waste management systems that dispose of rather than recycle waste, as well as the change in the composition of waste from largely organic to increasingly inorganic and toxic waste, made the recycling of waste into farming a complex task.

The industrialized “north” has largely separated food production and urban settlements. In the “south”, there has been less separation. In China and other Asian countries, vegetable and small animal and fish production continues to flourish in urban regions. Still, globally,

Figure 1.1 Evolution of the food-growing nutrient cycle



Source: J.J. Light, *Organic Food for the Soil* (Powys, Wales: National Centre for Alternative Technology, 1978), p. 8.

the food production function was reduced in numerous towns and cities.

What White and Whitney have referred to as “the traditional spatial nutrient cycling system of waste management” has thus disintegrated under multiple pressures.³ Figure 1.1 illustrates the shift from one model of urbanization—the closed (sustainable) loop, which existed before the Industrial Revolution—to another model, the open (unsustainable) loop. An increase in urban agriculture activities would heighten the possibility for food and fuel production to once again transform urban waste from a problem to a resource.

A “complete” or “sustainable” design for a city would be a closed loop, with all the wastes of one process used as an input of another process. A petrochemical complex can serve as a simple case in point. The city would be in balance with its bioregion and with the biosphere. Because food and fuel are a major industry in a city, urban agriculture has a large role to play in closing open, polluting loops in the nutrient cycle. Simply put, waste is food.

The urban food system

One way to understand urban farming is to study it as a part of the urban and national food supply and demand system, within the context of the urbanization process. The urban food system consists of (a) the food that urban residents consume, (b) the places where it is produced and (c) the often complex processes by which it gets from producers to consumers.

Food demand

Urbanization affects the food demand structure in a country. In cities, consumption of traditional basic foods (staples) often is replaced by consumption of more processed—and often non-indigenous—foods such as cereals and livestock products, along with a higher consumption of precooked and convenience foods. Thus demand for high-value crops, vegetables and meat products increases.

Urbanization affects not only the types of food demanded but also the levels of demand for food. Urbanization in developing countries is occurring at far more rapid rates than in Europe and North America. The speed of urbanization and the sheer numbers of people being added to urban areas are staggering. Between 1990 and 2020, Africa will add a half billion people to its urban population. In comparison,

between 1960 and 1990, North America and Europe together added 180 million people to their cities.⁴ The consequence is self-evident: more and more urban residents need to acquire food. Yet in many developing countries, agricultural productivity and the agricultural transportation and marketing systems are not developing at the pace needed to serve growing urban populations.

Food supply

From where, then, do people obtain their food? Villages get their food supply from farming within the settlement and surrounding countryside. In larger, more urban areas, however, the capacity of the immediate surroundings cannot keep up with the growing and changing food demand, as nearby farmland is taken over for urban uses. Consequently, farming in the region intensifies and adapts its crops to the new demand; the food-sheds expand along with the city they serve, and additional food is imported from other parts of the country or from abroad.

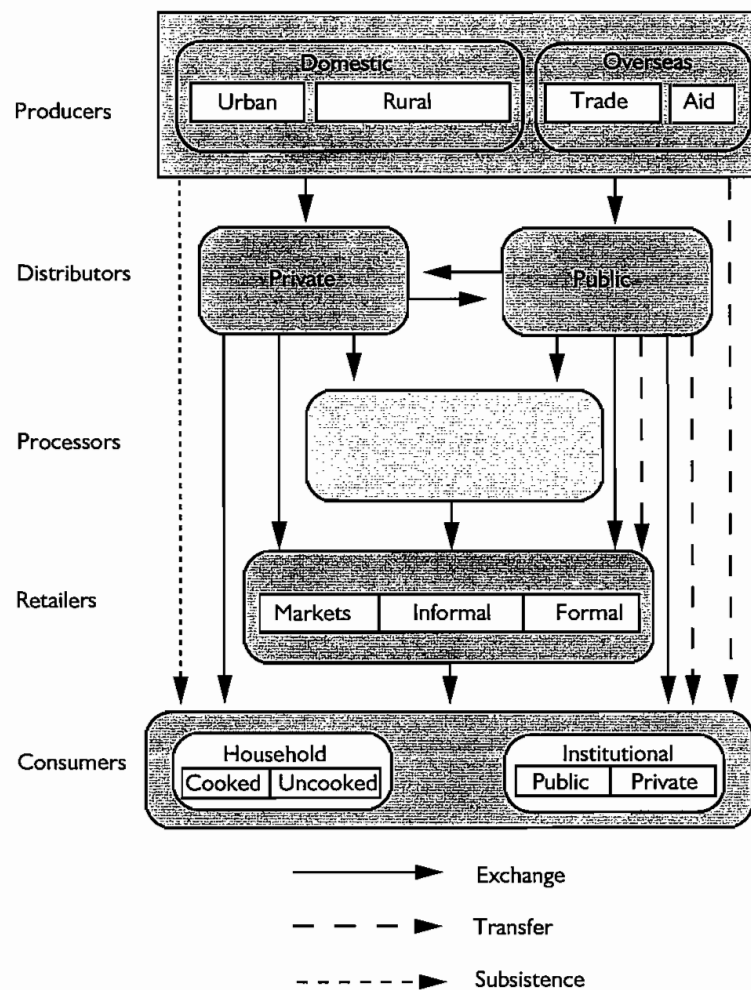
Thus urbanization calls forth the development of a more intricate national marketing and transportation infrastructure that can provide the city with food from remote rural and foreign sources. The urban marketing structures move gradually from the traditional petty trade structure—characteristic of smaller towns and villages—to formalized and capitalized market structures. Extensive storage, refrigeration and processing facilities are developed to increase the shelf life of food.

What has been found, however, is that the traditional food supply structure is being overlaid with, rather than replaced by, this new structure. This has come about as a result of the inability of the remote systems alone to nourish all urban residents at affordable prices. Remote food production now complements local ways of furnishing residents of urbanized areas with their nutritional needs. The complexity of the urban food system has therefore greatly increased.

Drakakis-Smith has presented a structural framework of the food supply system of cities (figure 1.2). It shows that urban residents acquire food through exchange (purchase or barter), production (home production, subsistence farming) or transfer (food aid, donation, food stamps, feeding programmes). The sources of the food may be rural producers, urban producers, import, food aid or own production.⁵

The food supply system can be viewed as a series of food-shed overlays of varying diameter, shape⁶ and direction from the city,⁷

Figure 1.2 Processes in the urban food supply system



Source: David Drakakis-Smith, "And the Cupboard Was Bare: Food Security and Food Policy for the Urban Poor", *Geographical Journal of Zimbabwe* 23 (1992): 40.

depending on the type of agricultural product. One old but still useful example is provided by a 1972 study of Hyderabad, India. It found that the population of 1.25 million at the time was serviced by three wholesale vegetable markets. Less perishable vegetables came from more distant sources, while almost the entire supply of more perishable products was grown within a 40-mile radius of the city. In the peri-urban zone, farmers practised intensive farming using electric pumps, producing three to four crops a year. Eighty percent of the milk consumed was supplied from the vicinity of the city, as was most of the poultry. Fruits usually came from a farther distance than vegetables and poultry.⁸

The amount of food supplied by the various sources—urban, rural and foreign—as well as the crops predominantly supplied by each source vary depending on various factors, including:

- ▼ The economic condition of the country
- ▼ The level of development of the food marketing, storage and transportation infrastructure and system
- ▼ Agricultural productivity
- ▼ Availability of land and water resources
- ▼ Agricultural and urban development policies.

Wherever the national food marketing and transportation system is not well developed, urban farming is particularly competitive. For high-value, specialty or perishable crops, urban farmers have the advantage of closeness to market as well as the means to follow the market closely.

The rapid growth of cities has been accompanied by a surge in urban poverty. In 1988, about one-third of the poor in developing countries were living in urban areas. By 2000, the proportion will increase to about 57%.⁹ Poor urban households generally depend on cash income to obtain food, for which they spend more than half of their income. The urban poor often respond by growing food wherever they can find access to land—either to add to the family larder, to have something to barter or exchange or to generate income.

The majority of urban farmers come from the poor. A prime reason these families become urban farmers is to gain food security, whether directly through the consumption of what they grow or indirectly through fungibility. What this study makes clear is that in developing countries, modern urban food systems (especially in the poorer countries) fail to achieve food security for the poor in the absence of urban agriculture, particularly during economic downturns.

After 150 years of increasing separation between consumption and production, there is substantial evidence that production is returning to the city and its edges in many places. After generations in which the food industry and agriculture focused their attention on greater efficiency in distribution and marketing, a shift is perceptible towards renewed investment in intensive, efficient and integrated production systems within the growing urban regions.

The shift has two components. The first focuses on the “urban” aspect of the urban food system. The relationship between urban agri-

and rural agriculture, and the purpose of each, are changing, with each producing those products at which it is most efficient (considering all cost factors) and for which proximity to market is most vital (rather than simply where the best conditions exist for production). Urban demand for food is satisfied from both urban and rural supplies. This not only gives an important role to urban food production, but also changes the overall function of rural food production.

The second shift bears on the “food” aspect of the system. As discussed above, food is not only a part of a demand-supply equation; it is also a part of a continuous cycle of nutrients generated and consumed by urban residents. This perspective on the urban food system reintegrates food with the urban ecology, tying resources to wastes and inputs to outputs.

Structure of urban agriculture

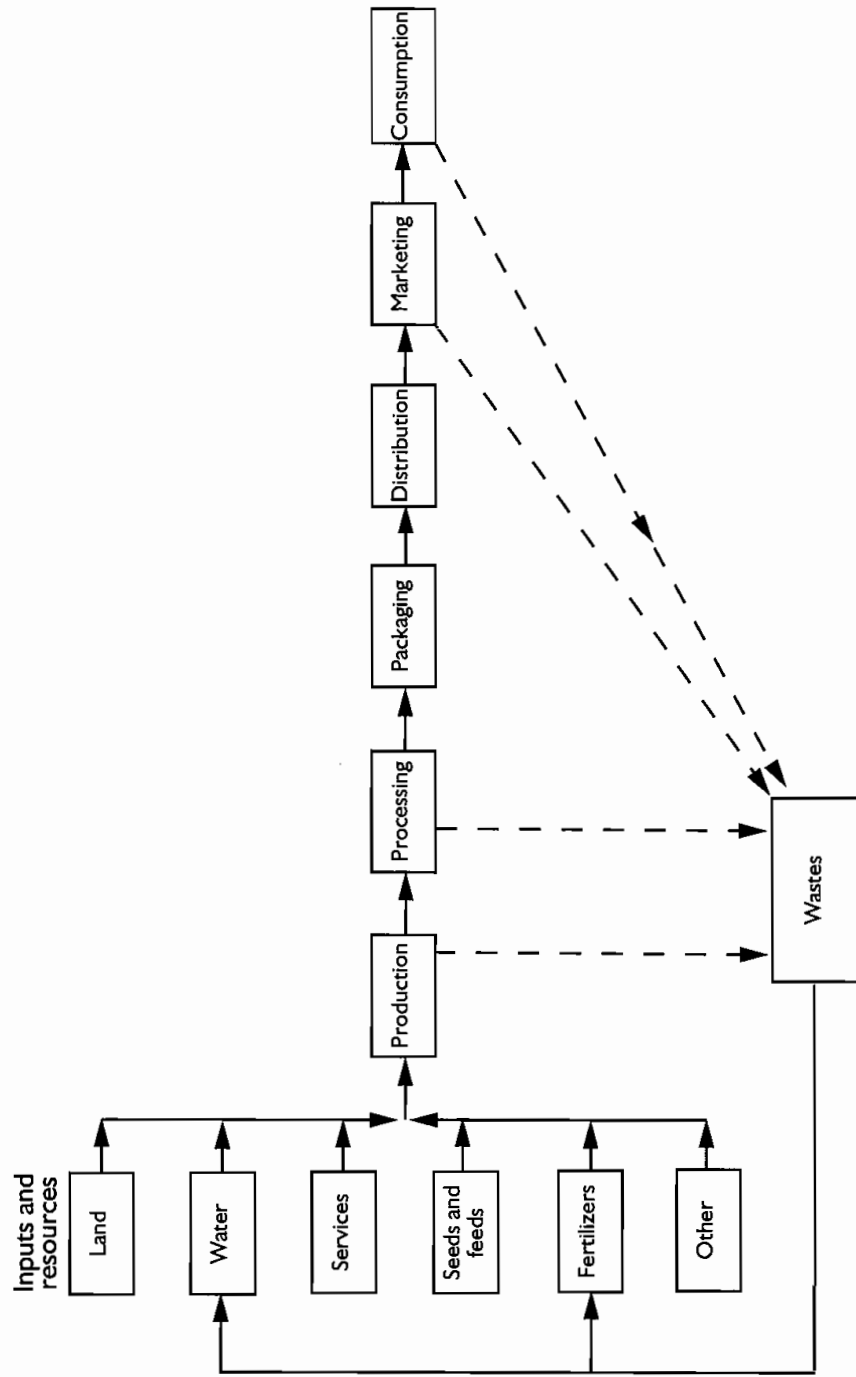
The urban agricultural subsector, like the larger agricultural sector of which it is a part, consists of seven vertically integrated processes: (a) acquisition and utilization of the necessary resources, inputs and services; (b) production of raw materials and finished goods; (c) processing; (d) packaging; (e) distribution; (f) marketing and (g) recycling.

Urban agriculture can be seen as having three general phases: preproduction, production and postproduction. Recycling transforms wastes into resources and inputs, and in that sense is part of preproduction. As many as four processes take place after production (processing, packaging, distribution and marketing). The relationships between the processes are illustrated in figure 1.3. The constraints these processes encounter are detailed in chapter 9.

Preproduction

Urban agriculture's needs for resources, inputs and services can be quite different from those of rural agriculture. When the supply of these is not adequately organized, the urban agriculture industry suffers. Less than optimal seeds are planted; planting time is not well attuned to market demands; the growing season is foreshortened; inefficient tools are used; losses are high and material that could be used to enrich the soil and water is dumped into the environment as pollution.

Figure 1.3 A closed-loop urban food system



Source: The Urban Agriculture Network.

In urban regions, the requirements for *land* and *water* are generally less per unit of production than in rural areas. Intensive vegetable production in urban situations may use only 5–20% as much irrigation water, and one-sixth to one-twelfth as much land, as rural, tractor-cultivated crops.¹⁰ Raising microlivestock or poultry takes little space compared with that needed for grazing cattle, since it can be practised in cages on rooftops and balconies. Fish ponds can produce up to 20 times more fish per cubic metre of water than stocked rivers and lakes can produce.

Inputs such as *tools*, *seeds*, *feeds* and *supplies* require a different distribution system in cities. Because most urban farmers are small scale and scattered across the city, they need different seeds and supplies than rural farmers. They must cope with different disease threats and microclimates than rural farmers and more polluted and depleted soils and water. The crops, production techniques, growing conditions, fertilizing matter (including organic wastes) and many other factors vary from those in rural areas and thus require different inputs. Appropriate tools are necessary for the intensive production, and farm plots are usually too small for use of large farm machinery.

Urban agriculture has some special *financing* needs as well. Other service needs of urban farming that differ from those of rural farming and improve its efficiency and performance include *training* of extension agents; special *information* programs and focused *research* into the crops, farming systems, techniques and problems that are specific to the urban setting. The technologies in a number of urban agriculture farming systems are improving in the 30 countries visited during the course of this study, especially in poultry and aquaculture, with more innovation and upgrading usually occurring in the farming systems favored by richer farmers.

Production

Urban agriculture is generally labour intensive and occurs in small plots that are distributed all over the city, although larger farms may be located in the peri-urban zone. Some concerns of rural agriculture (such as transportation costs and getting the product to the market while still fresh) are minimized with urban agriculture. However, other production considerations are more serious when cultivation takes place in urban areas, such as tenure insecurity, theft and environmental consequences. Of greatest concern is the assurance that

the food is safe for producers to handle and for consumers to eat (see chapter 8).

Urban farming is highly demand- and market-oriented. The vegetable farmer who farms on roadsides, in the backyard, on the roof or in a vacant plot plans cropping and production depending on what vegetables will be in demand when the produce is sold. The lower- or middle-income gardener cultivating for food security selects the mix of vegetables, fruits or animals season by season, based on the nutritional needs of the household.

Urban farmers are frequently small-scale entrepreneurs. In some cases, the urban farmer produces for barter with input providers, landlords, other small business persons and neighbours. The farmer may also work on direct contract for a retailer or food processing business.

Postproduction

Urban farm produce can be sold to a wholesaler or intermediary, directly to local markets or retail outlets, to processing facilities or to restaurants or street vendors of cooked food. Richer producers, such as poultry farms, may have direct contracts with supermarkets or restaurants. Poorer farmers in many cases will sell their produce themselves, at the farm gate or the local market. In that case, the two final forms of sale are (a) freshly harvested at the market or store and (b) ready to eat at a street food vendor's stand. The *processing* of the first is cleaning and possibly *packaging*, and of the second cooking and serving procedures of varying complexity.

Food-processing facilities are often located close to or in urban areas, offering urban farmers the advantage of proximity. Thus slaughtering and canning facilities may purchase animals, fruits and vegetables directly from local outgrowers. Products that receive further processing have additional value added, particularly in cities where refrigeration is lacking in many homes.

As a result of the simpler *distribution* system, fewer middlemen, as well as less storage, are needed than for rural farming. A substantial portion of what is grown in poorer cities is consumed by farmers and their families and friends or, through barter or sale, in the local urban market. Because *marketing* occurs close to the point of production and soon after harvesting, there is less vehicular traffic than for food produced in more remote locations.

In urban food marketing systems, both centralizing and decentralizing trends were detected. In several countries visited, including Nicaragua, municipalities are organizing centralized markets and moving petty traders off the roadside. In others, as cities spread, government-organized markets at central locations and on major railways and highways are becoming less and less relevant to the newer and less formal parts of the city, where localized markets emerge within the communities.



Urban farming makes increasing sense in today's urbanizing world. It is a realistic and necessary practice for the 21st century. As urban farming gains recognition as an industry with a role to play in the sustainability of cities and the sustenance of their residents, its full potential will become more achievable.

Notes

1. Delineating urban agriculture by using a food system approach that considers the area of influence rather than an administrative definition is fraught with inherent complications, as can be illustrated by a couple of examples. Rural farmers who come to the city to obtain composted urban solid wastes present one complication. Russian city dwellers who travel quite far by train (sometimes outside the urban area) to produce on a regular basis crops that form a stable part of their family's daily diet present another. Despite these quandaries, a broader system definition is still more appropriate, as it represents the true extent of urban agriculture.

2. For example, the boundaries of Chinese "urban areas" are drawn administratively to include a hinterland that goes well beyond what is generally considered to be urban or even peri-urban.

3. Rodney White and Joseph Whitney, "Cities and the Environment: An Overview", in Richard Stren and others, *Sustainable Cities: Urbanization and the Environment in International Perspective* (Boulder, Colo.: Westview Press, 1992), p. 15.

4. United Nations, Department of Economic and Social Information and Policy Analysis, *World Urbanization Prospects: The 1992 Revision* (New York: United Nations, 1993).

5. David Drakakis-Smith, "And the Cupboard Was Bare: Food Security and Food Policy for the Urban Poor", *Geographical Journal of Zimbabwe* 23 (1992): 38-58.

6. Food-sheds are often radial, extending along means of access, such as roads, waterways and rail lines.

7. Farming systems are frequently concentrated in certain districts, for a number of reasons. Most poultry may be to the northwest, for example, most vineyards on the foothills of nearby mountains, rice in the floodplain and aquaculture in coastal lagoons.

8. S. Manzoor Alam, "Metropolitan Hyderabad—Its Pattern of Regional Influence and Delineation of its Primary Planning Area", in A.C. Sekhar, ed., *Economic and Socio-Cultural Dimensions of Regionalization: An Indo-USSR Collaborative Study* (New Delhi: Office of the

Registrar General, 1971), quoted in L. Minerbi, *Planning Parameters for Food and Fuel* (Honolulu: East-West Center and University of Hawaii, 1983).

9. Barry M. Popkin and Eilene Bisgrove, "Urbanization and Nutrition in Low-Income Countries", *Food and Nutrition Bulletin* 10 (March 1988): 3-23.

10. John Jeavons, *How to Grow More Vegetables than You Ever Thought Possible on Less Land than You Can Imagine* (Palo Alto, Calif.: Ecology Action of the Peninsula, 1974); and Jorge Zapp, *Cultivos Sin Tierra: Hidroponia Popular* (Bogotá: United Nations Development Programme, 1991).

Urban agriculture yesterday and today

Urban agriculture throughout the world is undergoing a transformation in response to political, economic, environmental and technological change. Its emerging role in today's urbanizing world is just beginning to be understood and quantified. Data are limited and fragmented, but estimates of the number of people involved in various urban agricultural activities globally can be attempted based on projections from surveys and observations (table 2.1). The percentage of urban families engaged in agriculture varies from 10% in some large cities in North America to as many as 80% in some smaller Siberian and Asian cities.

During the 1980s, the importance of urban agriculture accelerated dramatically throughout the world. Surveys in Moscow in 1970 and 1991 indicate a shift from 20% to 65% of families engaged in agriculture.¹ Surveys in Dar es Salaam, Tanzania, in 1967 and 1991 show an increase from 18% to 67%.² Reports from Kinshasa, Kampala and Maputo speak of massive shifts of urban land from open space, institutional and transportation use to agricultural production. Studies in Kenya and Tanzania have found that three of every five families in towns and cities are engaged in urban agriculture.³

This high frequency of urban farmers is not limited to the poorest countries. Taiwan (province of China), whose population is primarily urbanized, reports that more than half of its families belong to farmers associations.⁴ In greater Bangkok, Thailand, 60% of the land was farmed in the 1980s, according to a government-sponsored land use survey.⁵

In the United States, more than one-third of the dollar value of the agricultural product is produced within urban metropolitan areas.⁶ Cairo reports 80,000 livestock within the city.⁷ Low-income

Table 2.1 Global estimates of urban agricultural activity

World population actively engaged in urban agriculture (many for consumption)		800 million
Farmers producing for the market (many part-time)		200 million
World employment in production and processing (full-time job equivalents)		150 million
	Preponderant range of data	Global general significance
Participants (share of urban families)	15% to 70%	About one-third of urban families
Production (vegetables, eggs, meat and fish)	10% to 90% of consumption	About one-third of consumption
Land use (land in agricultural use)	20% to 60% of urban area	More than one-third of urban area

Note: The intent is to present a thumbnail sketch of the significance of the industry. A more systematic estimation would be a major contribution to the body of knowledge.

Source: Estimates by The Urban Agriculture Network based on the authors' experiences and observations and on extrapolations from data from various official censuses and professional surveys.

women in Bogotá, Colombia, earn profits from growing hydroponic vegetables that are equal to or greater than their husbands' wages for semi-skilled jobs. The metropolitan region of Shanghai is largely self-sufficient in vegetable and small-livestock production—a remarkable accomplishment considering the high level of vegetable consumption.

The urban area in agricultural use may be greatly underestimated; in the Dar es Salaam district in Tanzania, for example, only 10% of the land farmed is officially recorded by the Regional Agriculture Office.⁸ Table 2.2 presents additional evidence of the extent and scale of the urban agriculture industry today.

A brief history of urban agriculture

Urban agriculture is a recent phenomenon in only a few places. Throughout the world, there is a long tradition of farming intensively within and at the edge of cities. This section reviews briefly the beginnings of urban agriculture and how it became what it is today.

Table 2.2 Selected data on the extent of urban agriculture

Country	Extent of urban agriculture
AFRICA	
Mali	Bamako is self-sufficient in horticultural products, and some products are shipped outside the metropolitan area for consumption.
Uganda	In Kampala, 70% of poultry needs (meat and eggs) are produced inside the city.
Zambia	In Lusaka, subsistence food production accounts for 33% of the total consumption by squatters.
ASIA	
China	In the 1980s, over 90% of vegetable demand and over half of meat and poultry demand in China's 18 largest cities was met through produce grown in urban areas.
Hong Kong	Vegetables sufficient to meet 45% of local demand are produced on 5–6% of total land area.
Indonesia	In Jakarta, almost 20% of the food consumed by squatters is self-produced.
Nepal	In Kathmandu, 37% of food producers surveyed met their household plant food needs and 11% met their animal food needs.
Singapore	Eighty percent of the poultry and 25% of the vegetables consumed are produced within the city.
NORTH AMERICA	
United States	Thirty percent of US agricultural product is produced within metropolitan areas.

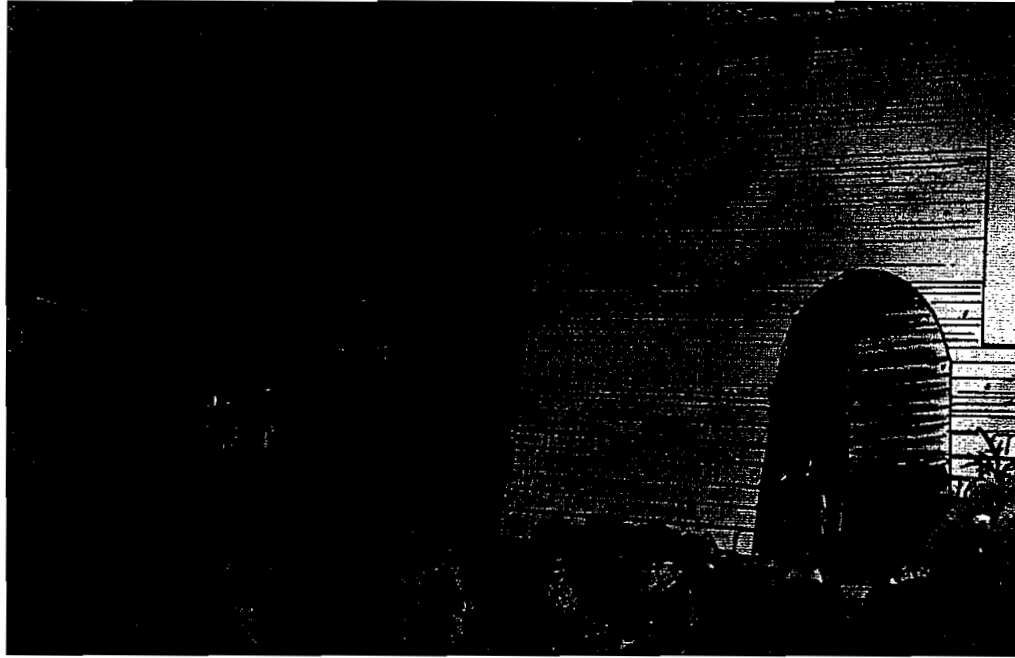
Source: Compiled by The Urban Agriculture Network from various sources.

The present mix of farming systems in cities was shaped primarily by four forces:

- ▼ The continuity of historical practices
- ▼ The industrial agriculture revolution
- ▼ Post–World War II rapid urbanization
- ▼ The great expansion of low-income segments of the urban population.

The first two forces give historical roots to urban agriculture; they help explain both continuities, in some instances, and changed practices, in others. The last two forces are mainly contemporary developments: rapid urbanization meant that the number of urban residents, particularly the urban poor who had to find ways to sustain themselves, expanded greatly the scale of urban agricultural activity. Thus the legacy of ancient and recent historical developments can be seen in the way urban agriculture is practised today.

Figure 2.1 Historical intensive gardening outside a Chinese walled city

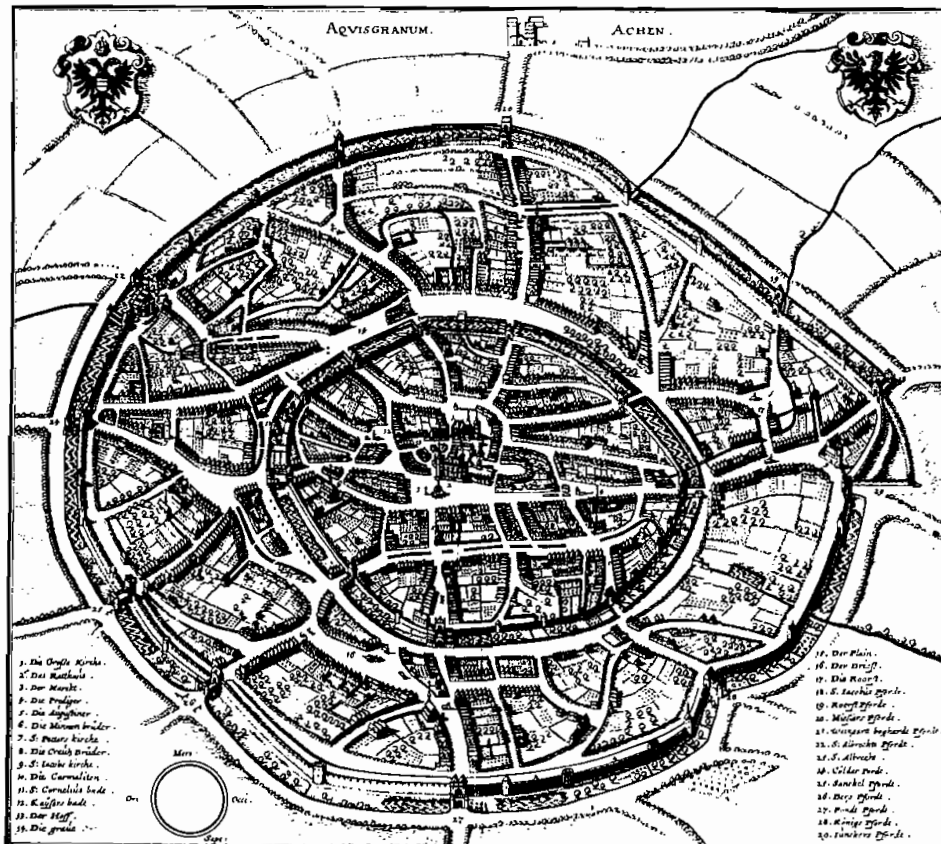


Source: Urban Resources Systems, San Francisco.

In all parts of the world, ancient civilizations developed urban agriculture systems to feed the cities. Some might argue that intensive food production is what allowed societies to create cities and civilizations. Examples can be found in Ghana, China (figure 2.1), India, Iraq, Java, Pakistan, Guatemala, Mexico and Peru. The intensive production of perishables, small livestock, fish and poultry within and abutting the city was essential to city life (figure 2.2). Grains, fruits and vegetables were shipped from the nearby countryside. In certain cultures, some crops, such as mushrooms and medicinal and culinary herbs, were especially developed in urban areas.

Among the most important historic cases to be “rediscovered” are the ones in Latin America (case 2.1). Aztec, Mayan and Incan cities not only were self-reliant in perishable fruits and vegetables, but also raised some grains within a confined hinterland. The towns and cities of early civilizations on Java and in the Indus valley similarly show traces of irrigated high-intensity farming systems. The Javanese aqua-terra system, combining multicrop water systems and multicrop soil farming systems, has to some extent survived, as have the Aztec aqua-terra *chinampas* in Mexico (figure 2.3). Similar systems are being studied in Ghana and China.

Figure 2.2 Plan of Aachen, Germany, 1649, showing widespread farming inside and outside the city walls



Source: Howard Saalman, *Medieval Cities, Planning and Cities Series*, edited by George Collins (New York: George Braziller, 1968), figure 24.

Case 2.1 Urban agriculture systems in pre-Columbian America

Machu Picchu, the “lost city” of the Inca, appears to have been self-sufficient in food within walking distance.⁹ The main city also had a suburb a few miles away that served principally for intensive agriculture. Land-form creation, water management and tree plantings stretched production to two crops a year at altitudes that had frost much of the year.

At Tenochtitlan, the site of Mexico City today, the Spanish invaders in the 15th century found the largest city they had known at the time. A principal source of food production was a form of aqua-terra farming now known as the *chinampas*. Irrigation systems helped farmers produce three crops a year in areas that today produce only one or two crops.

In addition to irrigation technology, ancient farmers had sophisticated methods of soil improvement and insect control. Manuals describe specific uses for human and animal offal and mixtures of them with other waste materials. Cities’ wastewater flowed into tanks, and from tanks to fields for irrigation. These systems were destroyed or their use disrupted by the Spanish conquerors.

In several sites in Peru, Guatemala and Mexico, agriculturists are reactivating the ancient systems and learning lessons about sustainable, intensive agriculture that are applicable today. In one case, production levels support two families on

Figure 2.3 Pre-Columbian *chinampas* of the valley of Tenochtitlan (present-day Mexico City)



Source: Urban Resources Systems, San Francisco.

one acre (0.40 hectare). One of the most important lessons is the use of aqua-terra systems in which water and land crops are produced in symbiosis (see case 4.6). These systems are particularly relevant to urban agriculture because they are efficient in areas of poor soil, steep slope and wetland. They depend for their productivity on the management of waste.

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In many ancient systems, the vagaries of climate were tempered through such techniques as irrigating to regularize the supply of water and warming the soil and air to stretch the growing season. In the desert climate of the Tigris and Euphrates delta, sun reflectors were used to heat the soil. At Machu Picchu, standing water in aqua-terra systems held off the mountain frost. In Bolivia today, as in earlier eras, the sun's heat is stored in the adobe walls of greenhouses. In Europe, compost, including horse manure, has long been used to heat raised vegetable beds.

Before "modern" urban sanitation systems were developed in the latter part of the 19th century, urban agriculture was the principal treatment and disposal method for urban wastes. Food was delivered

by donkey cart to the markets, and the city's wastes in turn were delivered to the fields—both rural and urban. One of the most famous—and most productive—examples in the modern era is the *marais* farming system of 19th-century Paris (case 2.2 and figure 2.4).

Case 2.2 The 19th-century *marais* of Paris

One hundred years ago a sixth of the area of Paris was used to produce annually more than 100,000 tons of high-value, out-of-season salad crops. This cropping system was sustained by the use of approximately one million tons of stable manure produced each year by the horses, which provided the power for the city's transport system. Sufficient surplus "soil" was produced to expand the production area by 6% a year. In energy, mass and monetary terms, the inputs and outputs of the Parisian urban agro-ecosystem exceed those of most examples of present-day, fully industrialized crop production. The productive biological recycling of the waste products of the city's transport system contrasts favorably with the requirements and consequences of the simplified, present-day urban ecosystems.

Thus Stanhill described the *marais* of Paris. This system became so well known in Europe in the late 19th century that very intensive horticulture using heavy inputs of biological origin is still called French gardening today. And *maraîchage* is the French term used for all market gardening.

In this system, three to six harvests a year were obtained through inter- and successional cropping. Year-round production was made possible by the heat and

Figure 2.4 Cultivation under *cloches* in the *marais* of Paris in the 19th century



Source: Urban Resources Systems, San Francisco.

carbon dioxide released from the fermenting manure, by the shelter provided by two-metre-high walls surrounding the properties, by glass-covered frames and bell-shaped glass *cloches* (covering a quarter of the total cultivated area) and by straw mats used to cover the crops during severe weather.

Marais cultivation was highly labour-intensive. It used heavy dressings of stable manure, equivalent to an annual application approximately 30 centimetres deep, spread over the entire farmed area. Surplus growing material was sold, recapturing up to a quarter of the cost of the manure. In addition, the city's sewage system was used for irrigated agriculture.

Fifty kilograms per capita of fresh salads, vegetables and fruits were produced annually, which exceeded the levels of consumption of these foods. Products were exported to as far away as London. Furthermore, as "the *marâchers* were interested primarily in maximizing the financial returns and to this end . . . concentrated on high-value, out-of-season winter crops and neglected the higher-yielding but lower-value summer crops," the annual production could have been even higher.

From the 1850s until the First World War, the area cultivated was fairly constant (approximately 1,400 hectares), as was the average size of a holding (three-quarters of a hectare), while monetary returns per hectare declined gradually. The population of Paris more than doubled during the same period.

The *marais* system reached its peak during the third quarter of the 19th century. Its rapid decline in the early 1900s can be explained by three factors: "The virtual replacement of the horse by the motor car, competition for land within the city, and competition from areas with more favorable climates outside the city—facilitated by improvements in the transport system." The *marais* cultivation system remains "one of the most productive ever documented". This biointensive system is now being copied worldwide, with the help especially of Californian researchers.¹⁰

Contact: See source listed in appendix C.

Some colonial cities incorporated the principle of using urban waste for enriching soils in urban and rural areas. In India, municipal sewage-based farms were introduced in the 19th century by the British, following Scottish practices, and several major ones survive today. In addition to sewage treatment, these farms produce fodder, coconuts and fuel cakes of dried sludge.¹¹ Over the past century, however, the trend has been to minimize the use of urban waste by introducing modern sanitation systems. The accepted ideal has become the "city beautiful" or the "city clean". In most developing countries, modern agricultural systems have replaced traditional ones.

Modern colonial cities were planned and managed to have food production at the outskirts or in the nearby hinterland using "modern" agriculture and producing "European" crops. The great Scottish urban thinker, Patrick Geddes, encountered these attitudes, which he deplored, when he visited the city of Indore in India during the First World War:

From the callous, contemptuous city bureaucrat at Delhi, I have now to tackle here the well-intentioned fanatic of sanitation—perhaps an even tougher proposition. Instead of the nineteenth century European city panacea of “Everything to the Sewer!” . . . the right maxim for India is the traditional rural one of “Everything to the Soil!” [thus creating] a verdant and fruitful garden environment.¹²

The struggle to “sanitize” the cities has been waged for more than a century now. There were, of course, legitimate public health concerns about the slums of Europe and the colonies. Sanitation systems, combined with changes in technologies, helped to clean up the urban environment. Nevertheless, the approach has created problems in both industrial and developing countries. The systems are unsustainable because they shift increasing volumes of wastes from one location to another within the urban ecosystem, and the infrastructure often fails.

In recent decades, agriculture was further dissociated from urban locations by well-intentioned and well-funded development experts. The division of the United Nations into many specialized agencies separated technical assistance for food production from the other disciplines important to urban agriculture, including health, nutrition, city planning and management, waste management and the environment.

With the multiplication of urban populations in most developing countries during the last half of the 20th century, urban food production and distribution systems became less and less reliable. Urban hunger multiplied with urban population growth, accelerated by political and economic instability. In response, urban agriculture became increasingly common in an ever-growing number of countries. Initially, urban residents themselves undertook urban farming. Only later did urban and agricultural researchers and policy-makers take notice of its significance.

With this rediscovery has come an exploration of past practices. Indeed, much is still to be learned from the food production systems of earlier civilizations and their related land use and infrastructure management systems. A review of urban agriculture as it is practised in Asia, Africa, Latin America, Europe and North America makes clear the debt that present-day urban agriculture owes to the past.

Asia

Urban agriculture was well established in Asia in the 19th century. It is still accepted in most Asian countries as a normal urban function and land use. Asia has the world's most diverse, and the greatest number of, modern intensive farming systems. Urban farms in Asia provide vegetables, poultry, mushrooms, fish, seaweed, swine, fruit, medicinal herbs and wood for furniture. Asian countries tend to have intense and widespread urbanization, a long tradition of urban agriculture and early recognition of the benefits of recycling waste for agricultural uses. A few countries are discussed here for illustration.

Before the railroads, the internal combustion engine and electrified cold storage, perishable foods had to be produced close to markets. Nineteenth-century China, with thousands of towns, large and small, excelled in urban agriculture. In the 1960s, China developed a specific urban development strategy that included partial self-reliance in vegetables and protein for its established large cities and growing towns (see case 6.2). This strategy included definition of broad urban regions, land use plans and waste recycling programmes to support urban agriculture (see case 9.3). These policies have continued into the 1990s, although they are suffering from increasing pressures.¹³

Following many different patterns, the major cities in China have achieved nutritional self-reliance in non-grain foods. At the same time, they have solved a large share of the urban waste problems of their regions—without increasing pollution. As in several other countries, urban agricultural production in China is dominated by women. Urban famines, which historically were frequent, have been avoided since the Second World War.

It is estimated that Hong Kong, the densest large city in the world, produces within its boundaries two-thirds of the poultry, one-sixth of the pigs and close to half the vegetables eaten by its citizens and visitors.¹⁴ The floats that carry the fish cages in the bays also support biointensive vegetable beds, and the duck and chicken wastes are used as food for the fish and fertilizer for the vegetables.¹⁵ Singapore is similarly effective in producing large quantities of food in a small, dense area (case 2.3).

Case 2.3 Urban agriculture in Singapore

The land use management practices of Singapore are among the most effective anywhere. For instance, Singapore has a public housing system recognized as one of the best in the world, and it manages its downtown traffic very skillfully.



Photo 2.1 Raised-bed horticulture in Singapore

The superior urban management is reflected in its successful urban agriculture system, which uses both ancient technology and advanced modern techniques adapted to its multiracial society. Singapore farms between the high rises and in its suburbs, and it farms the surrounding seas.

The Primary Production Department of the Ministry of Agriculture is responsible for applied research, extension, training and supplies for nutritional self-reliance in the island-nation. Most of the farmers it caters to run small operations and have been in business, on average, more than ten years. Singapore has both three-year and ten-year lease agreements with farmers depending on the type of crop and the abutting land uses. Rents are related to production, not land value. Among the other innovations are fish-horticulture mixed farming.

Singapore's citizens consume much meat (70 kilograms per capita per year), and Singapore is fully self-reliant in meat. Singapore also produces 25% of the vegetables its people consume. On about 7,000 hectares, Singapore licenses just under 10,000 farmers in fish, livestock and horticulture. Many householders are unlicensed small-scale producers as well.

The Primary Production Department has planned to an exceptional degree to recycle wastes into green areas, concentrating on livestock production, vegetable raising and fish farming. Organic wastes feed both land and sea crops, including seaweed and shrimp. Since 1974, mushrooms have been grown on multistory stacking shelves using composts from agricultural wastes such as banana leaves and straw.

Contact: See source listed in appendix C.

In Manila, a non-governmental organization, the Urban Food Foundation, and researchers at the University of the Philippines are promoting fruit, vegetable and livestock production, primarily by small farmers (see cases 3.4 and 9.5). An international agribusiness

exporting canned fruits and vegetables buys the produce from a large number of local growers. The University of the Philippines is also encouraging farmers to grow seaweed for export and to launch fishing enterprises.

By the early 20th century, Karachi, Pakistan, had a fairly advanced system of urban agriculture. Vegetables were raised in intensive beds irrigated with fresh water pumped from a subterranean river, and crabs were raised on city waste for the non-Muslim population. With the introduction of large-scale irrigation works and paved highways, food production moved away from the city, and post-World War II urban administrations discouraged urban farmers.¹⁶

Colombo and other cities in Sri Lanka have promoted the use of urban wastes and vacant land for small-scale production of nutritious food. This policy includes selling seedlings and providing technical advice to farmers at subsidized rates at commuter railroad stations.¹⁷ Indonesia also has a significant urban agriculture industry that has benefited from government support (case 2.4).

Case 2.4 Urban agriculture in Indonesia

Indonesia, particularly Java, has an urban agriculture tradition as old as China's. Both China and Java developed aqua-terra farming systems—in which land and water crops are farmed in former wetlands—centuries ago. The combination of the ancient Javanese multicropping technology, the long Dutch colonial period with its respect for intensive agriculture and the substantial Chinese population in Java has created a synergy in production techniques. Indonesian cities today feature Dutch hydroponics, Chinese raised beds and Malay fish cages.

The bays and estuaries of Java's coastal cities are intensively farmed, and the potable water reservoirs are leased to fishermen. Javanese home gardens traditionally have 20 to 40 crops; yields are highest within urban areas. Poultry has developed into a well-organized subsector (see case 7.4). Street food, which is available throughout towns and cities at all hours, is largely produced and processed within the settlements.

With support from the national and local governments, urban agriculture has been established as a substantial industry. Research is ongoing in universities and botanical gardens. Municipalities provide extension services and facilitate usufruct access to land and marketing assistance.

The Ministry of Research and Technology, responsible for long-range planning, has concluded that by the year 2000, Java, the densest and most urbanized island, must switch from primarily grain production to higher-yield crops, beginning with horticulture. Recent studies there have found that intensive, urban-type cultivation produces three to six times as much nutrition as multicrop rice production. The ministry has also supported research into small-scale composting for soil improvement and improved, sustained crop production.



Photo 2.2 Horticulture on surplus land at a racetrack in Jakarta. Solid waste from the adjacent community is collected for composting.

Some municipalities in Indonesia have agricultural departments with a full range of services. In one recent year, Jakarta distributed 290,000 fruit trees at token cost. The municipality's objective is to plant fruit trees on 23,000 hectares (36% of the city area). Land form and soil conditions make most of this area ill-suited to built-up uses.

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Japan has little cultivable land. A mountainous and populous island-nation, it has long been concerned with food security. As a result, most available open space in and near cities (on land, lake and sea) is put into agriculturally productive use.

The land use and tax systems in Japan favour urban agriculture. Japan is one of only a few countries in the world that include urban agriculture in the regular census, and the Japanese publish numerous papers on the subject of urban agriculture, although few have been translated.¹⁸ Special seeds, crop types and tools have evolved to serve the small plots of urban farmers, and the food marketing system is specially suited to them. Particularly noteworthy are the consumer-supported agriculture groups to which millions of Japanese consumers belong: they pay the farmer at the beginning of the season for the upcoming harvest, assuring themselves of a fresh and

steady supply while providing the farmer with an assured customer. This idea, which originated in Japan in the 1960s, “puts the farmer’s face on the product”.¹⁹

In general, other Asian countries have not been as supportive of urban farming. Thailand’s local and national governments, for example, have largely been unsympathetic to urban agriculture. India’s mixed support for urban agriculture has left it a relatively underdeveloped activity. Important exceptions include Calcutta’s wastewater fisheries and Bangalore’s fruit street trees, which provide vitamins to the city’s diet while saving on maintenance costs.

Some Asian farming systems have been introduced to cities throughout the world. Japanese immigrants brought their techniques to Brazil decades ago; Vietnamese immigrants brought their techniques to Côte d’Ivoire. More recently, the Taiwan-based Asian Vegetable Research and Development Center (AVRDC) brought research and networking programmes to Central America and East Africa.

Africa

Urban agriculture in Africa presents a contradiction: it has a relatively long tradition and is widely practised, yet in most African countries it has been undervalued and resisted by generations of public officials. This attitude has only recently begun to change as a result of an emerging awareness of urban agriculture’s potential to alleviate the growing hunger, economic and environmental crises in African metropolises.

Early colonial travelers reported aqua-terra farming systems in coastal Ghana. The oases of North Africa provide a clear example of intensive (urban-like) agriculture, making efficient use of wastewater and solid waste as an agricultural input. The cities of Morocco have a reputation for producing fresh vegetables for the city market. The Hausa cities of Nigeria (notably Ibadan) have a precolonial history of livestock and horticultural production; this practice continues and includes well-run markets.

In contrast to Asia, however, there has been only limited continuity of urban agricultural practices from the precolonial period to modern times. Many current African cities were established in the 19th and early 20th centuries by colonial rulers who had concepts of grandeur, precepts of cleanliness and a firm intent to distinguish themselves from “the bush”. In some cases, however, these rulers

encouraged urban agriculture on the periphery to grow high-value European crops for the colonialists.

Post-World War II independence was accompanied by rapid urbanization and, in most cases, rapid informal growth and development of urban agriculture. Bamako, Mali, for example, is reported to be self-sufficient in vegetables and to produce half or more of the chickens it consumes using technology introduced by the colonialists and adapted by local farmers (see case 4.5). In Kenya, urban farming occurs all over the cities despite little support from officials or non-governmental organizations.

In Lusaka, Zambia, a 1980 survey found that nearly 60% of low-income households cultivated either a home garden or a rainy-season garden away from the home—even though official policy until the late 1970s was completely antagonistic to urban farming, and city officials regularly slashed down maize crops.²⁰ In the late 1970s, the worsening economic and food supply situation forced a change in policy (see case 9.1).

In 1972, the Zairian government founded a cooperative to improve the supply of fruits and vegetables in the city; by 1984, the co-op had about 5,000 members. A survey in three city zones of Kinshasa found almost 70% of women practising agriculture in the early 1980s.²¹ Since then, urban farming has expanded even further as a result of the economic and civil crisis in the country.

During the 1980s, scattered innovations in urban agriculture took place throughout the African continent. Thai mushroom culture was introduced and flourished in Ghana. Lebanese immigrants brought intensive vegetable and flower systems to Senegal. As noted, Vietnamese immigrants brought Asian vegetable and fruit production to Côte d'Ivoire. Filipino seaweed production was introduced and flourished in Zanzibar. South African poultry technology was transferred to Zambia.

In addition, many cities evolved their own forms of urban agriculture. Most notable is the "roadside agriculture" that has developed within many African cities and for miles on the periphery; horticulture and grazing are being practised along roadsides as well as streamsides and in utility rights-of-way.

Urban parks and open spaces have been transformed into a "productive landscape", as public and private vacant or derelict land was converted to agriculture during a time of political and economic stress. In Maputo, Kampala, Kinshasa and elsewhere, cooperatives,

associations, individual entrepreneurs and corporations established new farming systems on land and water bodies previously not in productive use, thereby both feeding the city during hard times and helping to clean it.

Governments began to play a supportive role in the transformation of African cities in the 1980s. The capitals of Malawi and Tanzania were planned and developed to be self-reliant in perishable foods. Governments in Tanzania (case 2.5), Mozambique and Zambia adopted policies favouring urban agriculture.²² Addis Ababa promoted community gardens, and Douala assisted market gardening on airport grounds. Everywhere, as urban unemployment and hunger grew, many private and some public individuals and agencies responded pragmatically, using whatever technology was available.

Case 2.5 Urban agriculture in Tanzania

During the past 20 years, there has been a transformation in urban agriculture in Tanzania and in the attitude of the government towards it. Population growth has been a principal reason. Dar es Salaam has been among the fastest-growing large cities in the world. From 1967 to 1991, the proportion of families in the city engaged in farming rose from 18% to 67%. Other towns and cities in Tanzania have had similar increases, much of it in the 1980s. By 1988, one in five people of working age in Dar es Salaam was involved in some form of urban agriculture.

Tanzania has neither a history of urban agriculture nor a sizable immigrant population that brought urban agriculture with them. It appears simply to have grown up in response to need and to the opportunity afforded by the low-density urban pattern.



Photo 2.3 Urban cows and cowherd in Morogoro, Tanzania

In the 1980s, both the national and local governments adopted policies favoring urban agriculture on private and public land, in an about-face from earlier policies that had fought informal food production in cities. The 1979 master plans for Dar es Salaam and Dodoma included agriculture as a land use. Although this designation does not ensure that the land will actually be used for that purpose, it at least provides official recognition of the activity and is thus a measure of confidence in the farmer.

Urban farmers in Tanzania now span the income spectrum. They include a former high government official who raises cows in a fancy neighbourhood and whose neighbours emulate him (see case 5.7), agricultural college professors using imported technology to earn money on the poultry market (see case 5.6) and an enterprising farmer growing spinach in raised beds along a roadside (see case 4.4).

Without legislation, extension services, research or special credit facilities, urban agriculture has boomed in Tanzania. Once given the sanction to do so, urban farmers have creatively found or originated technologies and marketing systems that work.

Contacts: Dr. Camillus J. Sawio, University of Dar es Salaam, Dar es Salaam; L. Keith Lilley, GTZ, Arusha; and Dr. Zebedato Mvena, Sokoine University, Morogoro, Tanzania (see appendix F for complete address).

With a few exceptions, urban agriculture in Africa today is less efficient and productive than in Asia and Europe. In general, it falls into the informal “quasi-legal” category. It is typically underfinanced and uses lower-quality seeds, feed and other inputs. In most African countries, urban agriculture is split into farming systems of the rich and farming systems of the poor. The rich have access to better inputs, technical assistance and credit, while the poor by and large end up with low yields on land and labour. Poultry, European vegetables, fruits (especially citrus) and flowers are typical farming systems of the well-off. Nonetheless, urban agriculture is well established in Africa as an effective, vibrant, growing urban industry with excellent prospects.

Latin America

The tradition of urban agriculture seems to be at least as old in Latin America as in Asia, but there is less continuity. The Aztecs, Incas, Mayans and other pre-Columbian civilizations had highly developed, intensive agriculture systems, often using poorer soils than ancient civilizations in Asia and the Middle East. Most of these ancient systems were destroyed and abandoned with the European takeover. Today, researchers are examining the remaining evidence to learn from the highly productive and sustainable agricultural practices.²³

The Spanish and Portuguese cities in the Americas were designed, built and managed as headquarters for governing the hinterlands. Urban agriculture was resisted. After independence, and particularly with the rapid urbanization following the Second World War, urban agriculture re-emerged in the shantytowns surrounding the old colonial cities. In some cases (for example, the *chinampas*), the growing city engulfed a specialized farming system that survived the attacks of the urban managers.

Most of the new urban agriculture was based on rural European models and was not very productive. However, Asian technology using intensive production was introduced in some places, including in São Paulo by the Japanese and in Panama by the Taiwanese. Some French biointensive technology has been introduced by American and international humanitarian organizations. Some native animals, such as guinea pigs and iguanas, have been successfully adapted for raising in urban areas.

During the 1970s and 1980s, urban agriculture in Latin America received support as a social welfare programme from some governments, churches and charities. Activities ranged from school gardens supported by UNICEF in Panama²⁴ to a community garden in a prostitution district in northeastern Brazil. With the help of US technology, some urban agriculture was developed for export, most notably flowers from the Bogotá savanna and vegetables and grapes from the Valparaíso-Santiago plain.

In the 1980s, Asian and European technologies, especially in fish farming, were introduced on a larger scale. An outstanding example of the diffusion of a technology can be found in Bogotá, where a women's cooperative in a hillside slum learned to use European hydroponics (see case 5.5). This project is now sprouting offshoots in half a dozen Latin American countries.

In Mexico, salad cactus is grown in boxes for export to the United States and Japan. In Bolivia, an innovative greenhouse uses adobe architecture to store energy and reused plastic to transmit light and heat. In Peru, fish are produced using wastewater following an Asian model (case 2.6). In addition to Peru, one other national government (Argentina) and several municipal governments supported urban farming in the 1980s. São Paulo and Curitiba, in Brazil, have urban agriculture programmes, as does Mexico City.

In April 1995, 50 urban agriculture experts and project managers from Mexico to Argentina met in La Paz, Bolivia, and formed

the Latin American Urban Agriculture Network to promote the industry. The tradition of urban farming in Latin America may thus be coming full circle from the days of the Incas and Aztecs before Columbus.

Case 2.6 Urban agriculture in Peru

Peru has traveled a rocky road politically and economically in the past couple of decades. During this period, urban agriculture has contributed to averting disaster. Squatter communities have been planned and developed to include agriculture as a basic economic activity. Women's groups have promoted programmes of food production for the family (see case 7.2). Community kitchens, where families acquire and prepare food as a community, have established kitchen gardens to keep vitamins and protein in their diet (see case 7.1).

The national government has established a unit within the Ministry of Agriculture to promote urban agriculture. HUFACAM (Huertos Familiares, Arborizacion y Crianza de Animales Menores) cooperates with 100 other agencies and institutions, including a prison and several non-governmental organizations (NGOs). Its programmes have more than 220,000 beneficiaries through 44,500 farmers in 33 towns in Lima, Piura and Cuzco districts. HUFACAM provides some inputs, assists with access to land and water (including reuse of water) and includes rabbits and ducks with its field and tree crop promotions.

The sewage-fed fish technology developed at a research center, CEPIS, is being considered for adoption in Bolivia, Mexico, Colombia (Cali) and Cuba (see case 5.2). It is being advanced in Peru by a government agency, PRODANET, to green the desert. CEPIS has received World Bank support, and PRODANET is supported by the Food and Agriculture Organization. Other NGOs are doing advanced applied research in composting, guinea pig rearing and microenterprise and are promoting these methods in surrounding countries.

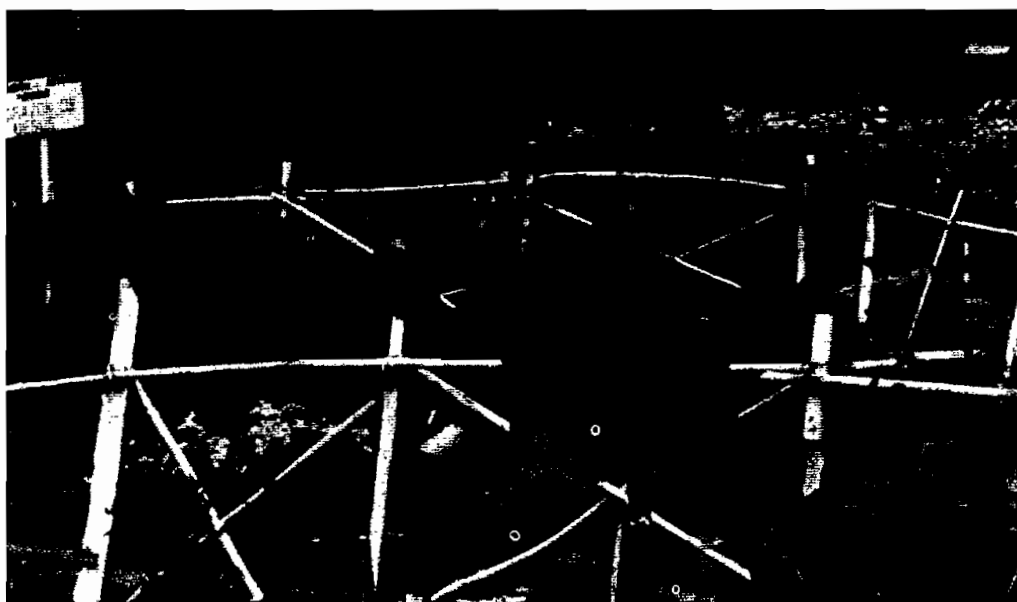


Photo 2.4 Community kitchen garden supported by CARE in Lima

Peru—a small, poor country—is successfully applying new techniques and organizational approaches to promoting urban agriculture. It could benefit substantially from international assistance for this endeavor.

Contacts: José Andres Dasso, Peru Mujer, Lima; Julio Moscoso, CEPIS, C.P. 4337, Lima 100; and Ing. Manuel Orozco Ramos, Ministry of Agriculture, Lima, Peru.

Europe and North America

The benefits of urban agriculture in wealthy countries are quite different from those in less developed countries. Food security is less of a concern in wealthier countries for several reasons: (a) food costs for lower-income groups may be one-fifth to one-third of urban family budgets (compared with one-third to four-fifths in poor countries); (b) food distribution systems are generally more complete; and (c) food is both of higher quality and more accessible.

Cities in more developed countries generally are less densely populated and have more available land for raising crops and animals. With increased consumption, however, the per capita volume of wastewater and solid waste is higher, and the potential environmental hazards of those wastes are usually greater.

In Europe and North America, governments have provided substantial support for the last 100 years both for the rural industrial sector of agriculture and for small rural family farms. But there has been relatively little support for urban agriculture. Agricultural education and research have all but ignored urban agriculture, except in specialized applications such as poultry, aquaculture and hydroponics.

Urban agriculture began a decline in the late 19th century, which accelerated after the Second World War. In the 1970s and 1980s, there was the beginning of a resurgence. Some of the signs of a comeback in European and North American urban agriculture are discussed here.

Europe

In Italy, small-scale urban farmers have organized into cooperatives and associations to protect their interests. They are closely tied to the “green” movement and insist on the merits of locally grown produce. In France and Germany, the “sustainable agriculture” movement is growing and includes urban farmers; among other causes, this movement promotes nutritionally self-reliant communities. Denmark’s advanced programs of “co-housing” often include community food

production. Switzerland is a world leader in the consumer-supported agriculture movement. The Netherlands has a history of intensive urban agricultural production (case 2.7).

Throughout Europe there is a new interest in community gardens, or "allotments". There are 80,000 community gardeners on municipal land in Berlin, with a waiting list of 16,000; together, these gardeners are a strong political force.²⁵ In the early 1990s, Norway and Austria drafted national food policies that include a commitment to greater self-reliance, with a focus on the small sustainable producer; these policies will encourage urban and peri-urban agriculture in these predominantly urban countries.

Case 2.7 Urban agriculture in the Netherlands

The Netherlands is perhaps the world's premier agricultural producer of specialty crops. It is also one of the world's most densely populated and most urban nations. This apparent contradiction of being highly urban and densely populated and also a leader in agricultural production is explained in part by the government's support for urban agriculture.

The *Randstad* is the main concept that shapes planning and zoning in the Netherlands. It seeks to maintain an agricultural interior within the regional South Holland "Rim City", which includes Amsterdam, the Hague, Rotterdam, Delft and other towns and cities. This "green core" features high-value crops, plastic shelters to stretch the season, marketing cooperatives, extension services, research centres, credit facilities, firm environmental controls and training.

Such intensive farming began in the last century when the Dutch agricultural industry realized it had no space to expand and decided to concentrate on increasing yields and value per unit of available space. This is the essence of urban agriculture everywhere: define the market and increase productivity.

Contact: Dr. Ann Waters-Bayer, ETC Foundation, P.O. Box 64, Leusden 3830 AB, Netherlands.

The countries bordering the Mediterranean Sea are leaders in the use of plastic domes and tunnels and controlled irrigation to stretch the season, save on water consumption and increase yields per hectare. Much of this increased production is in peri-urban areas.

Russia and other countries in Eastern Europe are in the midst of an agricultural revolution from public to private and from large-scale to small-scale units of production. The shift in just 20 years in the number of Moscow families engaged in food production (from 20% in 1970 to 65% in 1990) is remarkable. Similar, if perhaps less dramatic, shifts are occurring in many Eastern European cities as policies and economies change.

It is noteworthy that the pattern of urban construction under the former communist regimes creates a unique opportunity for promoting urban agricultural production. Because urban expansion was concentrated in planned high-rise mini-cities, a great deal more open land exists near the 19th-century urban centres than in North America or even in Western Europe. Thus there is considerable potential for expanding urban agriculture around and within the densely built-up core and housing estates. As energy and transport costs multiply under the new economics, urban food production offers increasingly more advantages.

North America

In North America, urban household food production and peri-urban market gardening were significant subsectors of the food and agriculture system until the 1950s, when they declined in all but small towns. In the 1970s and 1980s, there was a resurgence in community gardens and home gardens, partly as a result of a growing concern about food quality, which increased consumer demand for locally grown products.

The 1994 national gardening survey revealed that 30% of US families are gardeners, with fully 80% of these urban dwellers.²⁶ The American Community Gardeners Association was formed to increase the sense of community among gardeners. As in Europe, the community-supported agriculture movement is beginning to expand in North America.²⁷

Since the early 1970s, New York City has supported more than 1,000 community gardens on public land. The government has opened 18 farmers markets for direct sale of locally grown farm products. Other US cities such as Boston and Philadelphia have even more community gardens per capita than New York. In Seattle, New York and Washington, DC, projects assist the homeless in producing their own food and assist community and home farmers in contributing fresh food to their homeless neighbours.

A number of universities have begun to support the growing industry, notably Rutgers University in New Jersey, the University of California at Davis and Cornell University in New York. In 1994, the University of California at Los Angeles completed a thorough study of the food system of Los Angeles.²⁸

The role of urban food production and distribution is beginning to be recognized by local and regional planners. A number of cities,

metropolitan regions and states or provinces are therefore developing urban food policies and food strategies, including Toronto (Ontario), Chattanooga (Tennessee), Hartford (Connecticut) and the states of Massachusetts and Oregon. These policies and strategies include greater nutritional self-reliance. So far, the resurgence of urban agriculture in North America has been characterized by public-private partnerships that have largely left out national governments.

The 1980 US census found that urban metropolitan areas produced 30% of the dollar value of US agricultural production. By 1990, it had increased to 40%.²⁹ At the same time, as urban areas expand, thousands of acres of peri-urban land are lost from agricultural production. Although this loss is recognized more and more as an issue of national as well as local significance, the importance of metropolitan intensive production is not yet fully realized. Higher-value crops such as poultry and vegetables make a particularly significant nutritional and economic contribution.

Summary: Comparisons across continents

Over the past few decades, there have been dramatic shifts towards urban agriculture in developing countries. The volume of production has increased, and improved technologies and methods have been developed.

In most countries, urban farming resulted from the initiative of enterprising farmers who saw the market opportunity or responded to the possibility of improving family security. In only a few cases did it develop through government foresight. In fact, in most countries urban agriculture receives little official support; in many countries, it is still resisted.

Certainly, Africa has shown the most dramatic expansion—in countries with civil strife, such as Zaire, Uganda and Mozambique, and in the greening of cities like Dar es Salaam and Nairobi when administrative repression was relaxed. Urban agriculture in Africa is probably less formally organized than it is in any other continent. Undoubtedly, it has been the most extensively surveyed during the past decade.

Latin America is probably the least advanced continent at present, but it has some of the most impressive technological advances. Latin American non-governmental organizations (NGOs) appear

to be particularly effective in promoting urban agriculture. Not only are individual agencies more effective, but they also cooperate more with one another than do NGOs in other regions.

Urban agriculture is most extensive in Asia, but the growth and change in the industry is less apparent. Both municipal and national governments in Asia are more supportive of urban farming than governments in Africa and Latin America. The need for assistance to the urban poor in urban agriculture is no less pressing in Asia than in other parts of the developing world. The assistance should theoretically be easier because the know-how is more ubiquitous.



The examples offered here reveal the great diversity in urban agriculture, which makes broad generalizations difficult. Ancient civilizations, medieval cities, the wealthiest countries in today's world and countries and cities surviving civil strife or economic duress have incorporated urban agriculture in their development. These differences in circumstances also mean that regional variations in benefits, problems and constraints will need to be understood and appropriate strategies devised for each locale.

A fragmented picture could be assembled from the examples cited so far of urban agriculture around the world. In chapters 3 through 6, a more systematic effort will be applied to covering the full range of urban farmers, agriculture locations, agricultural processes and products and actors that influence the urban agriculture industry.

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P a r t

two

What is urban agriculture?

Who are the urban farmers?

In Nairobi, a young mother finds a place on the roadside near her home where garbage has been dumped and burned over the years. Recognizing the better quality of the soil, she establishes a bean and maize mixed-crop garden. From her harvests she feeds her family, sets aside dried beans for the dry season and sells roasted ears of maize for cash at the roadside garden site.

In metropolitan Jakarta, a transnational agribusiness firm establishes a vast, shed-grown mushroom farm and an adjacent cannery for world markets. The spent mushroom soil is sold to small-scale vegetable farmers, who use it to improve the soil in their gardens.

Both the young mother and the transnational firm are urban farmers. However, each has special support requirements and makes different contributions to the economic, social and environmental makeup of the city.

In most developing countries, the majority of urban farmers come from low-income groups. Frequently, they farm on land they do not own. However, in some countries (including Argentina and the United States), middle-income farmers, practising primarily “backyard” cultivation, are in the majority. The motives of middle- and upper-income home farmers are often nutritional (cleaner and healthier home-grown food for the family) and cultural rather than economic. In all groups, the presence of cultivators often acts as a catalyst for others to do the same.

In most countries, urban agriculture is dominated by small producers achieving food security and earning income for their families. However, the smaller number of large producers—domestic private and public corporations and multinational agribusinesses—produce a significant share of the total value of urban agriculture, particularly in capital-intensive farming systems such as aquacul-

ture and poultry. Larger enterprises and more wealthy entrepreneurs are more likely to have access to such requirements as inputs, land, water, credit, technology, extension support, training, markets and market information.

The difference between the farming practices of low-income and high-income farmers is usually not just one of size, but also of farming systems and products. While monocropping is common among wealthier farmers, lower-income farmers tend to choose multicrop farming systems that require low capital and minimize risk (for example, combining vegetable and rabbit production). The higher the farmer's income, the more specialized and high-value may be the crop or the market to which the farmer caters (for example, mushrooms, shrimp or flowers for export). Table 3.1 shows the kind of urban agriculture practised in selected cities around the world.

This chapter discusses the role of the various participants in urban agriculture, including low-income farmers (both those who grow for their own consumption and those who grow for the market), middle- and high-income farmers (who also may grow either for their own consumption or for sale to the market), agribusinesses, farmers cooperatives and special groups of farmers such as women, migrants and refugees.

Low-income farmers

The majority of urban farmers in most of the countries examined for this study belong to low-income groups and practise farming on a part-time basis. Often, one working adult in the family (usually a woman) is the principal farmer and others support the production, processing or marketing functions. For many urban families, however, agriculture is not just a side activity; it is the basic source of income throughout the year, and day labour in other industries provides supplementary (cash) income on an intermittent basis.

Low-income urban residents engage in agriculture primarily to increase their food security and their income levels (case 3.1). By growing their own food, they also improve their nutritional intake, since the food they grow is more nutritious than the food they can afford to buy. Less recognized, but also important, is the benefit of fungible income that farming provides by freeing up cash for essential

Table 3.1 Presence of urban farmers in selected cities

Country	Prevalence of farming
AFRICA	
Burkina Faso	Thirty-six percent of families in Ouagadougou are engaged in horticultural cultivation or livestock.
Cameroon	In Yaounde, 35% of urban residents farm.
Congo	Eighty percent of families in Libreville are engaged in horticulture.
Kenya	Sixty-seven percent of urban families farm (80% of which are low-income) on urban and peri-urban sites; 29% of these families farm in the urban areas where they live. Twenty percent of urban dwellers in Nairobi grow food in the urban area.
Mozambique	Thirty-seven percent of urban households surveyed in Maputo produced food. Twenty-nine percent raised livestock.
Tanzania	Sixty-eight percent of families in six Tanzanian cities are engaged in farming; 39% raise animals.
Uganda	Thirty-three percent of all households within a five-kilometre radius of the center of Kampala were engaged in some form of agricultural activity in 1989.
Zambia	A survey of 250 low-income households in Lusaka showed that 45% grow horticultural crops or raise livestock in the backyard, front yard or in gardens on the periphery of the city.
ASIA	
Fiji	In Suva, 40% of families are engaged in horticulture.
Nepal	In Kathmandu, 37% of households raise horticultural crops and 11% raise animals.
Papua New Guinea	In the Port Moresby metropolitan area, about 80% of all households take part in some food production.
EUROPE	
Russia	In Moscow, 65% of families were engaged in agriculture in 1991, compared with only 20% in 1970.
NORTH AMERICA	
United States	Twenty-five percent of urban families work in food gardens or horticulture.

Source: Compiled by The Urban Agriculture Network from various sources.

expenditures other than food. In many Third World cities, food purchases can represent over 60% of total family expenditures (see table 7.3). For the very poor mother, cash and food may be almost equivalent, as much of the first is spent on the second.

Consumption-oriented farmers, producing for family and neighbours, represent a significant population in most low-income cities. A 1986 survey in Kenya found that of the urban families engaged in agriculture,

as many as 40% were dependent on self-produced food for nutritional survival.¹ The impact of this activity can be significant. In the Philippines, the district of Negros promoted home, school and community gardens with support from the International Institute of Rural Reconstruction. Low-income community residents produced vegetables, fruits, herbs and other products for both consumption and sale; within two years, childhood malnutrition was cut from 40% to 25%.²

Case 3.1 Small-scale horticulturists in a squatter settlement in Lusaka

Residents of a squatter settlement near the sewage lagoons in Lusaka, Zambia, farm the area to produce food for consumption. The production is small-scale and informal, using low-quality inputs collected from the market or neighbouring areas and undertaken on public land. Although it is legal to use public land for cultivation in Zambia, using sewage for irrigation is not sanctioned. In this case, the effluent from lagoons has been biologically treated in a passive lagoon.

The farmers produce vegetables such as squash and beans for family consumption. One farmer has expanded his farming activity to produce cash crops such as sugar cane for toddy and bananas, from which he earns a good income. He has shaped fields by hand and uses crop rotation. The farmer composts neighbourhood waste for his fields and uses effluent from the sewage lagoon for irrigation.

Contact: Harrington Jere, Human Settlements of Zambia, Lusaka, Zambia (see appendix F for complete address).



Photo 3.1 Urban gardener and his family cultivate for their own consumption and the market in Lusaka

Some urban farming systems that require low levels of capital, inputs and skills are easy-entry/easy-exit economic activities, which makes them very attractive to individuals with few resources at hand. In Haiti, very low-income farmers produce crops on rooftops using green manure made entirely from collected organic waste. The crops are for home consumption and sale within the community.³ On the garbage dumps east of Calcutta, hundreds of small cooperatives, comprising low-income urban residents, pay rent to the city and produce one-fifth of the city's fresh vegetables.⁴

Monetary investment by the low-income farmer is often quite small, with many inputs obtained by barter. Still, access to resources (seed, land, water), technology and support (credit, marketing) is highly constrained for these farmers. In the face of poor-quality inputs and crop loss to insects, disease and theft, the failure rate is frequently high, and the return to labour, efficiency of production and per-hectare yields tend to be low.

For many, urban agriculture is a relatively long-term economic activity.⁵ The average low-income farmer is a member of a poor but stable urban community.⁶ The poor who have lived in the city for a number of years have better access to resources and greater familiarity with the market and the urban economy. Recent migrants into the city from rural areas, including refugees, can rarely put together the necessary access to land, water and other inputs. They also face problems in effectively adapting rural technologies and farming systems to the urban environment; much relearning is necessary.

Urban agriculture is an effective family security tool for those seeking to build a future in the city. When the poor cannot purchase food in the market because of a lack of cash or disruption of supply, cultivating food may be the only means of survival. Individuals often first take up urban farming during worsening economic times, war or other catastrophes that disrupt food supply channels. A typical first venture may be to plant cassava roots on a roadside with a prayer for rain, or spinach next to a leak in a sewage pipe. Commonly, beginning farmers scavenge seeds from market wastes and cultivate on an irregular basis.

Over time, farming may evolve into a stable source of family income. With appropriate assistance and support, a farmer who is producing for home consumption can increase returns sufficiently to make sustained farming profitable and more productive. A farmer then may begin bartering for other family needs and selling parts of the larger crops. In many countries, there is a direct connection between low-

income entrepreneurs and retail markets such as street food, roadside stands and municipal markets.

Cooperation and organization have a vital role in low-income farmers' ability to expand their activities (case 3.2). In some places (for example, Senegal), the men tend to the crops and the women do the processing and marketing. Members of one tribe in Dakar work together to farm the tribal land to produce vegetables, rice, fish and livestock for the city market. In Lima, a community kitchen run by poor women supplements the rice, beans and cooking oil it receives as welfare by growing vegetables in community gardens and raising rabbits and poultry in backyards to provide a healthier diet for its members.

Case 3.2 Backyard gardeners in Maipú using biointensive methods



Photo 3.2 Husband and wife backyard gardeners in Maipú, near Santiago

Farmers in a low-income settlement in Maipú, Chile, grow a mix of vegetables, herbs and fruits and raise microlivestock on small household plots ranging from 10 to 40 square metres. Farming began about ten years ago through the initiative of SODEM, a Maipú-based community development organization, with training provided by the Centre for Education and Technology (CET), a national technical NGO advancing alternative agriculture. Several international agencies, including CODEL, GTZ and Lutheran World Relief, formerly provided support.

The farmers collect garbage from neighbouring residences and compost it for farming input. For most families, farming is a second economic activity; they produce primarily for consumption by family and friends. A few pro-

duce for sale in the market. Some women farmers grow culinary herbs at home and sell them in the local market.

The original purpose of the project was to improve the food security and nutritional status of the settlement residents. But farmers gradually expanded their activities. The farmers have planted street trees to improve the neighbourhood environment and for collective marketing of fruit. The farmers are now well established; they have even created a city park that has farming as well as recreational space.

This model of cooperation among NGOs to promote urban farming is eminently replicable in other countries and cities.

Contacts: Camila Montecino and Rita Moya, Centre for Education and Technology (CET), Colina, Chile (see appendix F for complete address).

In addition to the better-organized groups of poor urban farmers, thousands of small, productive farmers in every town and city generate some income from farming. These farmers are not reported in most economic and nutritional statistics, as their activity tends not to be noticed. The line between cultivation for consumption and for profit is often blurred among low-income farmers, who move easily from cultivation for their nutritional survival into selling surpluses and growing market crops.

Middle- and high-income farmers

Middle- and high-income farmers, like low-income farmers, either may cultivate for their own families and communities or may be entrepreneurial farmers seeking a profit. They, too, run viable farms in cities around the world. However, despite their many commonalities with low-income farmers, there are some distinct differences.

Middle- and high-income *consumption-oriented farmers* have a different set of priorities and farm differently from lower-income farmers. They frequently farm to substitute healthier, home-grown food for store-bought products and for personal satisfaction from the act of cultivating. Growing food for consumption improves the quality and nutritional value of the foodstuffs consumed by the family, as well as frees up income for other consumption needs. It provides significant quality-of-life benefits, including improved nutrition, security against dependence on a single-wage income and a stock of out-of-season canned and preserved foods.

Sometimes, however, the reasons for farming are economic. For many, urban agriculture offers a low-investment opportunity to be in business for themselves. For others, urban agriculture provided the equivalent of unemployment insurance during the recession of the 1980s, which has persisted in numerous countries. Falling real wages mean that middle-class expectations for living and consumption standards are no longer matched by incomes. In Argentina, for instance, pensioners unable to survive on their pensions alone farm in their yards to make ends meet.

So-called structural adjustment programmes in the 1970s and 1980s led to declines in the real incomes of urban populations, especially in Africa, motivating a significant percentage of the population to grow food for home consumption.⁷ A survey in Tanzania found that

70% of the resident faculty at one agricultural campus were entrepreneurial urban farmers who found the income an essential supplement to their shrinking salaries.⁸

Farming is usually a part-time activity for one or more family members, with some input from the rest of the family. A typical example of a home farmer is a middle-class mother producing vegetables and fruits in her kitchen garden with planting and harvesting help from the family or day labour.

Growing food at home is a low-risk way to supplement the family income because many middle-class families have some farmable land or surfaces available at home, making food production a convenient secondary activity. For these farmers, the issue of tenure is usually not as critical as it is for lower-income farmers since they generally farm in their own yard or on other land they hold. They also have access to better seeds, feeds and other inputs than do lower-income farmers, and their livestock and vegetable beds tend to be more robust.

Middle- and high-income *entrepreneurs*, in contrast to gardeners for family consumption, tend to concentrate on high-value crops rather than easy-to-grow crops; they frequently concentrate on a few or even a single crop, such as cattle, ornamental plants or spinach. Farming still tends to be family-based, although larger enterprises may have several workers.

One middle-income Zambian family involved in entrepreneurial urban agriculture finds farming much more lucrative than the husband's accounting job. Their farm income is more than double his salary. He handles purchasing and marketing, and his wife does the field work. Another Zambian family produces a second income through ornamental horticulture (case 3.3).

These entrepreneurs are more likely than low-income entrepreneurs to have legal right to farm the land and to have access to good inputs, technical advice and credit. When asked what his number one problem was, an extension worker in Mexico answered, "College professors producing market crops in their backyard. They ask too many questions."

Case 3.3 Growing ornamental crops at home in Lusaka

A middle-income family in Lusaka, Zambia, produces a second income by growing potted house plants in their front and back yards. The family produces its own pots, makes soil from neighbourhood waste and markets the plants directly to homeowners. The father is the principal farmer. The mother holds a government job and



Photo 3.3 Middle-income ornamental horticulturists at work in their front yard in Lusaka

is the expert horticulturist and market specialist; she works on the business in her spare time. The children help as well.

This successful ornamental horticulture enterprise is supported by a farmers association, which provides both technical advice and some credit. There is a large market for house plants in most cities worldwide, and several low- to middle-income farmers are supplying each local market.

Contact: Lyson Phiri, Africare, Lusaka, Zambia (see appendix F for complete address).

The main difference between middle- and high-income entrepreneurial farmers is in the scale or capital requirements of their

ventures. Rich investors, particularly if they have an agricultural background or are landowners, are attracted to farming systems that require high investments and produce high returns, such as large-scale poultry and dairy products, or that cater to specialty markets, such as shrimp and orchids for export.

Like the middle-income entrepreneur, the big investor is likely to concentrate on a single, high-value crop and to either own the land or lease it from the government, institutions or other landowners, including speculators. Examples of investments are land improvements to create ponds, irrigation, greenhouses, mushroom sheds and storage facilities.

Many high-income urban farmers integrate their operations into processing and marketing, including for export. They often expand to higher-return specialty markets. In Tanzania, a retired high government official imports hybrid milk cows and raises them in his exclusive residential neighbourhood. In Colombia, a former high-level official in the agriculture ministry exports culinary herbs to the United States.

These enterprises are often peri-urban. As land prices rise, these farmers sell their facilities and move their operations to the new urban periphery. Increasing urbanization is often accompanied by a shift to a more profitable and complex farming system or to more intensive crops. It is not unusual for a successful higher-income farmer to become an agribusiness entrepreneur. In Thailand, a farmer who had



Photo 3.4 Kitchen garden for a restaurant in greater Bogotá

inherited fruit orchards from his father sold them for a considerable sum and purchased land at the Bangkok metropolitan periphery to build artificial ponds for fish rearing.

Thus middle- and high-income entrepreneurial farming may be viewed by the public and by the state not as agriculture but as agribusiness. This perception has implications for the degree of official support the activity commands. Urban agribusiness is supported and promoted in most countries as a productive industry with good access to credit, technology and other requirements; other, more informal urban agriculture fails to receive the same status.

Domestic and international agribusinesses

Large national and international corporations play a major role in urban agriculture, sometimes dominating a farming system. Large operators can have two different roles: they can produce crops themselves, employing large numbers of workers; or they can contract through numerous small and medium “outgrowers”, handling the processing and marketing functions themselves. In Abidjan, an integrated chicken-raising firm produces poultry feed and owns and operates retail outlets throughout Côte d’Ivoire. For larger (including multinational) firms, the advantage of proximity and concentration of farmers in urban and peri-urban areas may make them more convenient outgrowers for crops that require fast delivery to the market. In Bangkok, a single large firm



Photo 3.5 Medium-size poultry business in Lusaka

has contracts with 10,000 small outgrowers of chickens. It runs the hatcheries and processes the meat it buys from the small growers.

In many urban areas, aquaculture, especially growing shrimp, is dominated by large firms. For example, an international agribusiness giant produces mushrooms in Jakarta. Although in some places legislation bars small-scale farmers from holding pigs, a number of municipal corporations raise pigs on garbage.

Some agribusinesses support small-scale producers (case 3.4). Others compete with their smaller counterparts. This competition can be uneven when agribusiness has preferred access to land, water, waste or other inputs. Cooperatives, farmers associations, non-governmental organizations (NGOs) and other groups can help to level the playing field by providing assistance to small farmers.

Case 3.4 Vegetable and fruit production by Del Monte in Manila

Del Monte, an international agribusiness, was growing fruits and vegetables on a plantation in Manila, Philippines, for export in canned form. During the 1980s, the Urban Food Foundation, an NGO based in Manila, helped Del Monte to move from a plantation-based system to an outgrower-based system, with Del Monte contracting out production to about 500 small- and medium-scale farmers in metropolitan Manila. Del Monte performs the marketing, technical assistance, extension and quality control functions.

The farmers are part of a farmers association whose professional executive manager previously worked for Del Monte. The quality of life of farmers is much improved over that of plantation workers.

Contact: Roberto S. Guevara, Urban Food Foundation, Quezon City, Philippines (see appendix F for complete address).

Farmers cooperatives

Cooperatives of farmers are usually formed to increase the sustainability of the farming activity by reducing input costs or increasing profits, thus reducing risk. By joining into cooperatives, small operators gain economies of scale in areas such as technical and enterprise support, supply of inputs and marketing. Cooperatives ease the access of small farmers to formal markets where these are not easy to enter.

In urban areas, cooperatives tend to comprise lower-income farmers, although wealthier farmers also form their own specialized associations. Community gardening everywhere, from Leipzig to Lima, is typically operated through community gardening associations or cooperatives. In Germany, community gardens are rooted in the labour union movement of the 19th century. In Peru, they emerged from the alternative economics movement of the 1970s.

In Jerusalem, outside Bogotá, a cooperative of 100 poor women grows hydroponic vegetables on contract with supermarkets at premium prices. In Zaire, the cooperatives of urban farmers were partly instrumental in reducing the problems caused by recent breakdowns in food supply from rural and international sources.

Farmers often start with common interests (for example, a common activity in a common location, similar background or solidarity), then join together to achieve certain benefits, resolve certain problems and protect certain interests. Over time, they may formalize their association and work with outside experts to achieve these goals. Many cooperatives are formed with impetus from an outside catalyst such as a development agency or an NGO. Yet there is no clear line distinguishing farmers cooperatives, farmers associations and NGOs. All of these groups can be classified both as producers and as actors that influence and organize urban agriculture, as the example of fisheries cooperatives in India illustrates (case 3.5).

Case 3.5 Sewage-fed fisheries cooperatives in Calcutta

Calcutta, in West Bengal, India, has the largest water area devoted to aquaculture using urban wastes in the world. About 175 fisheries based on sewage, ranging from four to 80 or more hectares in size, produce fish (tilapia, carp, rohu, catla, mrigal) for the local market. The fish farms are in the wetlands area in East Calcutta.

About 150 landlords have long-term leases from the municipality and the port authority for these properties. The farming is done by some 4,000 families, most of whom migrated from the Sunderbans region in East Bengal (now Bangladesh)



Photo 3.6 Lagoon in Calcutta farmed through a fishermen cooperative using treated sewage

in the 1950s. The fishermen, who rent the ponds from the landlords, are organized into several cooperatives.

There is a tradition of strong fishermen cooperatives in the state of Bengal. The cooperatives are organized for production at the local level. At the district level, central societies or associations handle purchasing and supply of inputs. The West Bengal State Fishermen's Co-operative Federation, Ltd., a state-level organization, helps in the management of cooperative societies and arranges supply of inputs and finance.

Farming of fish on sewage-fed ponds began in this area during the Second World War, gradually expanded to the current level and may now be shrinking somewhat, in size if not production. Some form of resource recovery from the sewage has been continuous since the middle of the 19th century. The discharge from the fishponds—treated wastewater—is used to irrigate non-monsoon (dry season) rice paddy and vegetables.

The farms produce about four to nine tons per hectare annually (according to 1984 data) and satisfy up to 20% of the city's fish demand. The city sewage that feeds the ponds is appropriately treated through methods developed by the fishermen over the years. The fish have been found for more than 20 years to be safer for consumption than river-produced fish.

The area provides multiple benefits: fish supplies to the city; biological treatment of city sewage by private profit-making and tax-paying organizations; recovery of nutrients that would otherwise pollute; and preservation of the wetlands. The fisheries area itself provides open space in a crowded city. The ponds and dikes are used for boating and picnicking, particularly on weekends. The cooperatives play a vital role in the effectiveness of this well-integrated system because coor-

dination and control, which are essential to the system's long-term maintenance, would not be achievable by individual fish farmers.

The sewage fisheries are facing a threat from urban development. Further, the productive capacity of the ponds is endangered by siltation and dike erosion. In recent years, the farmers in the region have united to form a Waste Recycling Region Development Committee to work for preservation of the farming, fishing and recreation activities. The committee has gained the support of national and international environmental groups in a battle with real estate interests.

Contacts: Dr. Dhrubajyoti Ghosh, Calcutta Metropolitan Water and Sewer Authority, Calcutta, India; Professor Christine Furedy, York University, Toronto, Ontario, Canada (see appendix F for complete address).

Special groups of farmers

Although the practice varies from one society to another, it is common for urban farming to be dominated by minorities or economically disadvantaged populations. For instance, in Tanzania urban agriculture employs a higher percentage of youth, aged and unskilled labour than other informal industries. Such demographic realities explain in part the lack of recognition and support for urban agriculture and therefore have important policy implications. Three groups of disadvantaged farmers stand out in particular: women, immigrants and those farming in response to crisis.



Photo 3.7 Women selling their farm products at a street market in Abidjan

Women farmers

The image of the male as the family provider is common in many cultures. However, household surveys in countries throughout Africa and Latin America find that women are more commonly accountable for family food production and preparation. Perhaps because feeding the family is the responsibility of the woman, she is more immediately conscious of deficiencies in food security and the first to seek opportunities to augment food supply.

In some low-income economies, women are not fully integrated into the urban workforce. Their lack of access and familiarity with the formal economies limits the economic activities they can engage in. Furthermore, responsibility for managing the household and raising the children imposes additional restrictions on the range of other work women can do.⁹ Farming has the advantage that it can be undertaken close to or at home.

In countries and cultures where women do most of the rural farming, women are also likely to do most of the urban farming, according to most researchers in Sub-Saharan Africa and Latin America (table 3.2). Surveys in Kenya and other East African countries show that three-fifths to two-thirds of the primary urban farmers are women, who receive some help in planting and harvesting from their families.¹⁰ The Centre for Education and Technology (CET) in Chile finds that women represent 90% of the urban agriculture producers in their low-income areas.¹¹ In a Lima study, four-fifths of home gardens were found to be farmed by women.¹² In Port Moresby, Papua New Guinea, a 1981 survey found that 67% of the principal gardeners were women.¹³ In some countries and cultures, however, including Senegal and

Table 3.2 Gender composition of urban farmers in selected cities

Country	Gender composition
AFRICA	An estimated 64% of African urban farmers are female.
Kenya	In Nairobi, 65% of urban farmers are women.
Uganda	In Kampala, 67% of urban farmers are older women.
Zaire	In Kisangani, 64% of urban farmers are women.
SOUTH AMERICA	
Colombia	Sixty-seven percent of the hydroponic cultivators in the Jerusalem project in Bogotá are women.

Source: Compiled by The Urban Agriculture Network from various sources.

Senegal and Argentina, our field visits and interviews found that the majority of urban farmers are men.

When both husband and wife are otherwise employed, women are more likely than men to be engaged part time in food production. In Dar es Salaam, some women employed by the government first supplemented their meagre incomes by urban farming; after a few years, the women took up urban agriculture full time. As a full-time occupation, their farming income was on average five to ten times their salary.¹⁴

In general, it appears that male family members are more likely to be active in cash-earning activities than in fungible ones. In Bolivia, for example, women are concerned with food crops and men concentrate on cash crops.¹⁵ A similar pattern is found in Zambia.

Women's importance in urban agriculture is not limited to food production. Women are more likely to be engaged in processing preserves, spices, relishes, salsas and dried food for family and neighbours and for the market. In some cultures, women are the primary marketers of urban agricultural products. In Africa and Latin America, one can see more women than men selling food on the street and in the markets. Gathering wood and manufacturing fuel from urban waste are also commonly women's work and enterprise. On the other hand, collecting and processing solid waste for soil improvement and livestock fodder is more commonly done by men and children in urban situations.¹⁶

A number of studies have defined the greater difficulties that rural women farmers face compared with men. Field interviews suggest that the same bias exists for urban women. Urban women face greater difficulty than men in attaining access to land, water, credit, extension services and essential inputs.

Some constraints women face arise from the specific urban context. In some parts of Africa, for example, women have traditionally had the right of access to tribal land for vegetable production. When the family moves to the city, women's accountability to feed the family continues in the culture, but the traditional usufruct to land is lost with formal land titles and land use laws.

Immigrant farmers

In many cities, immigrant groups bring new technologies from their native country or region. Japanese immigrants are well-known mar-

ket gardeners in California and southern Brazil. On the North American east coast and in Argentina, Italians have been important urban gardeners. In Côte d'Ivoire, Vietnamese immigrants have far higher yields per hectare than the native farmers. In Senegal, the most productive farmers are the Lebanese; in Panama, as in much of Asia, it is the Chinese.

Expatriate participation in urban agriculture is more pronounced in some farming systems (such as fish, mushrooms, vegetables and ornamental horticulture) than in others (livestock, fruit orcharding and poultry). Those who come from countries with an urban agriculture tradition are more likely to take up agriculture in their new settings. But as opportunities present themselves in growing urban food markets, other immigrants will join them.

However, rural farmers may need help in adapting rural technologies and methods to their new urban setting. Programs to assist immigrants in relearning farming in an urban setting could help to accelerate these groups' transition into productive urban life.

Immigrant farmers may also face problems in gaining access to markets and in adapting farming technology to local conditions. Finally, urban agriculture is perceived in some places as being of "low status" because it is practised by immigrants.¹⁷ Being viewed as an immigrants' trade can have cultural and policy implications for the industry because the stigma sometimes discourages native groups from taking it up.

Crisis farmers

Refugee camps, whether formal or informal, generally have urban characteristics. This is particularly true of the increasingly common camps of long duration, some of which become semi-permanent. From the day of formation, each camp begins to shape its own special economy—part subsidy, part trade and part production. Because the largest part of such an economy is food, urban agriculture can play a special role.

The recent trend among refugee organizations is to emphasize a degree of self-reliance among refugee camp inhabitants; this independence can encompass nutritional self-reliance, particularly in micronutrients. Since some of the inputs to agricultural production will be the camp's wastes, the burden on the surrounding local community's infrastructure can be reduced. The camps can achieve some

food self-reliance if the agricultural inputs are provided to the refugees. The farming activity is also likely to lead to some social satisfaction and increased community interaction.

Crops with a short maturity cycle can be grown even in short-term refugee camps. Whether they are of urban or rural origin, a significant proportion of the refugees are likely to have some farming skills, and land is usually available in or around the camps.

Urban agriculture may have a role to play not only in emergencies where large population movements take place, but also where temporary breakdowns in food supply to cities occur through natural, civic, economic or wartime disasters. Food production may come to a standstill, the infrastructure may collapse and distribution in particular may fail. In addition to taking steps such as reducing consumption and recycling, portions of the population may turn temporarily to farming to survive the crisis. Such temporary farming activity was noted recently in the former Yugoslavia, Baghdad and Kinshasa.¹⁸ Many mayors of disaster-struck cities have responded by making public land available to residents for food production; this practice was particularly widespread on both sides of the Atlantic during and after the Second World War.



Photo 3.8 "Victory garden" in front of the San Francisco civic centre during the Second World War



There is no such person as the "average urban farmer". He or she may come from any portion of a city's population spectrum. She is often a woman working on a small scale, less than full time. Urban farmers include the wealthy and the poor, recent immigrants and landed gentry. During the 1980s and early 1990s, the number of urban farmers grew rapidly, probably faster than the rate of urbanization.

Although they represent a significant share of the population in numerous developing-country cities, urban farmers face considerable obstacles and biases. They are pioneers in an important industry without the benefits accorded most industries by government, associations and commercial organizations. Nevertheless, in one place after another, urban farmers are beginning to be heard and noticed. National policies favouring urban agriculture are being established, national associations are being formed, surveys are being carried out and in a few cities and countries, government departments are becoming operational.

Notes

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3. See *ECHO Development Notes*, issue 40 (and other issues), published by Educational Concerns for Hunger Organization (ECHO), North Fort Myers, FL 33916-2239 USA.
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9. Rakodi, "Urban Agriculture," p. 496.
10. This was a finding of several surveys, including those by the Mazingira Institute (Kenya) and Sokoine University (Tanzania).
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16. African Development Bank, loan to Addis Ababa, 1993; presentation by J. Arroya Moreno, Instituto de Promoción de la Economía Social (IPES), Lima, Peru, at a USAID-sponsored workshop on the Habitat II conference, Arlington, Va., 11 April 1995.
17. Walther Manshard, "Market Gardens in West African Urban Communities" (Freiburg, Germany: Institut für Kulturgeographie der Universität, n.d.), p. 7.
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Where is farming found in the city?

A close look around most developing cities reveals urban agriculture everywhere. Urban agriculture is so much a part of the landscape that it is often not even noticed: fruit trees along streets, a backyard vegetable garden, trees for fuel and construction wood in peri-urban areas, vegetables grown on slopes in low-density areas of the city, fish in ponds, a chicken farm inside an industrial district, a greenhouse behind a petrol station.

Yet the widespread perception is that cities in developing countries are solidly built up, with no area to spare. Agriculture and urbanization are viewed as conflicting activities, and any non-built use of land is seen as temporary. The World Bank, for example, in an otherwise perceptive analysis, labelled the considerable open space in greater Moscow as “vacant”.¹ Yet most of this land is in fact agricultural and is helping Moscow’s population sustain itself in the face of the collapse of the Russian food supply system.

In most developing-country cities, considerable vacant and under-utilized land and water surfaces in the urbanized sphere are or can be used for agricultural production (tables 4.1 and 4.2). Furthermore, the agricultural use of areas at the edge of cities is not necessarily a marginal use; rather, it is an integral part of that urban area’s expanding productive system. As the city grows, agriculture can grow with it, even as the periphery extends and housing and commerce take over farm sites.

Historically, towns were situated in their particular sites for a variety of reasons, for example, it was a strategic spot or crossroads, or it provided sheltered harbour. No matter what the reason, the site typically had to be accompanied by adjacent surfaces that were sufficiently fertile to feed the population of the settlement. In fact, the towns that survived and flourished and became the metropolises of today were often located in the most fertile parts of a country or region, especially

Table 4.1 Extent of urban land used for agriculture in selected cities

Country	Land used for agriculture
AFRICA	
Mozambique	In Beira, 88% of the "green spaces" in the city are used for family agriculture.
Nigeria	In Zaria, 66% of the city area is cultivated.
ASIA	
China	In Beijing, 28% of the city is in agriculture.
Fiji	In Suva, 50% of the open land on the peninsula is under cultivation.
Hong Kong	Ten percent of the land is in agriculture, which produces 45% of the fresh vegetables, 15% of the pigs and 68% of the live chickens consumed by Hong Kong's population. Vegetable growing and fish ponds occupy 31.1% and 18.7%, respectively, of all agricultural land use in Hong Kong.
Papua New Guinea	In the national capital district, about 80% of all households take part in some food production, on a mean area of 372 square metres.
Singapore	In 1979, 10,595 hectares of land were cultivated in Singapore.
Thailand	In Bangkok, 60% of land in the metropolitan area is in agriculture.
EUROPE	
Spain	In Madrid, 60% of the metropolitan area is in agriculture.
CENTRAL AMERICA	
Costa Rica	In San José, 60% of the metropolitan area is in agriculture.

Source: Compiled by The Urban Agriculture Network from various sources.

those that grew as "market towns". It is no coincidence that capitals such as Bogotá and Cairo are located in the midst of productive plains. Furthermore, the most fertile lands are often the easiest to extend infrastructure onto, and therefore the most suitable for urbanization.

The questions of where food production and urbanization take place are intimately connected and should be evaluated jointly. In addition to the diverse types of characteristically urban sites described in this chapter, there are "quasi-urban" sites where variations on the principles of urban agriculture apply, for example, refugee camps. If refugee camps are viewed as temporary cities, certain types of cultivation are appropriate and help reduce total dependence on assistance programs as well as provide a worthwhile social activity (see discussion in chapter 3).

Urban agriculture includes many farming systems. These diverse systems have widely different demands for urban space. Soilless horticulture and small-livestock production are compatible with

Table 4.2 Types of land used for urban agriculture in selected cities

Country	Type of land
AFRICA	Nearly 60% of all urban farmers do not own the land on which they farm, and more than 40% use public lands.
Kenya	Less than a quarter of farmers surveyed in Nairobi use their own or their family's land. The lots are cultivated for an average of 7.2 years. Of the farmland studied in Nairobi, 41% was owned by households, 22% by the municipality, 20% by the government, 7% by private firms and 11% by other entities. Households obtained access to this land through purchasing (21%), gifts (59%), renting (4%) and other means (16%).
ASIA	
Fiji	In Suva, 20% of home gardeners plant along road frontages, and another 20% grow crops on unused open land.

Source: Compiled by The Urban Agriculture Network from various sources.

neighbourhoods that are entirely built up and paved over. Orchards and agroforestry require relatively large parcels of land in long-term lease or permanent ownership. Thus, although the simple answer to the chapter's title query is "everywhere", the more complete answer is that there is an appropriate place for many different kinds of farming systems somewhere between the city centre and the rural-urban fringe (see also table 5.1).

In answering the question of where in the urban region farming takes place, this chapter addresses four issues:

- ▼ What type of physical space is used?
- ▼ How long are the growing surfaces available?
- ▼ Where within the metropolitan area are the growing surfaces located?
- ▼ Under what form of tenure are the land or water surfaces held?

Classification schemes set up in response to these questions are neither comprehensive nor mutually exclusive, since the categories overlap. Nevertheless, they provide a useful way to examine the many different places in which urban agriculture takes place.

Types of spaces used

Urban agriculture takes place in many different places, including spaces on and around buildings; community lands and parks;

areas allocated to other uses, such as roadsides and rights-of-way, that are made available for farming; and areas not suitable for building, such as floodplains, wetlands, steep slopes, airport buffers and bodies of water.

Around the house

The most obvious and well-known place to grow food within an urban area is the yard around a house. While the backyard is the most significant yard for food production, side yards (where they exist) and front yards are also exploitable. However, the front yard presents some particular concerns; it is more accessible and therefore more exposed to theft and vandalism, and the crops are more easily contaminated by lead from vehicle exhausts.

Many urban residents, especially in larger cities, do not have yard space but do have other household surfaces where food can be grown. The potential for the use of rooftops, patios, balconies and so on for growing vegetables and raising microlivestock for consumption and sale is significant (case 4.1).

Vertical space can be used effectively for growing food. Walls can hold cages for poultry and livestock as well as vines. Recent hydroponic techniques minimize space needs with plastic tubes that can be suspended on brick walls. Some city farmers attach long, narrow planters or boxes to their walls. Others hang plastic pots or tops and bottom halves of plastic soda bottles. Many plants, like cucumber and melon, are happy to grow up a wall or fence if supported with sticks or twine.

Residences have the potential to be three-dimensional places of agricultural production. Field visits to some homes provide an eye-opening experience in how resourcefully home surfaces, even in apartments, can be used. The range of what is grown in and around homes goes beyond just vegetables and fruit trees. Medicinal herbs are grown on rooftops in Santiago, silkworms on balconies in Old Delhi, pigeons in downtown Cairo, rabbits in Mexico City shanties and orchids inside rooms in Bangkok.

In Haiti, the German technique of shallow-bed farming was introduced by a Florida-based organization, Educational Concerns for Hunger Organization. Many low-income farmers now produce vegetables in shallow beds (one to two inches of organic waste) in soil-less yard spaces and on rooftops (see case 5.4).

One analyst has identified four advantages that household gardens have over other food production sites in urban areas. First, tenure of the land around a house is generally more secure relative to other locations. Second, proximity to the home saves time and effort: there is no “commuting cost” to gardening. Third, water is more available for irrigation than, say, along roadsides. Finally, the homegrown crop is normally less prone to theft.²

Nevertheless, home gardens can contribute only so much to urban agriculture. Many homes are overcrowded and have little or no surplus space available. In particular, the poorest households are least likely to have access to a home garden. Therefore, the household’s garden is often located away from the home.

Case 4.1 Growing rooftop and patio salad cactus in Mexico City

Cactus cultivation for household consumption in salads and as a cash crop is well established in household yards in peri-urban Mexico City. The cactus is also exported to the western United States and Japan.

COCODER, the agriculture department of the capital district, is helping promote farming of cactus as a low-cost fresh crop among urban households that do not have access to yard space. As a result, cactus is now grown in boxes and pots on rooftops and patios, with COCODER providing marketing assistance, and production is intensive. Because requirements for technical skills and inputs are low, cactus cultivation can be taken up by less-skilled farmers.

Contact: Manuel Barcelo, COCODER, Mexico City, Mexico (see appendix F for complete address).



Photo 4.1 “Cactus in a box”, Mexico City

Community spaces

After the home, community gardens are the most common site for urban food production. A community garden is a condominium or cooperative, in which shareholders or participants each cultivate their own plot and share responsibility for common garden elements such as pathways, fences, water supply, storage and security. Community gardens are particularly common in cultures where a long tradition of urban multicrop gardening exists.³ Berlin has more than 80,000 community gardeners on more than 2,000 sites.⁴

Community gardens have institutional, locational and social characteristics. They are often supported by non-governmental organizations (NGOs) and local government. Some become a social centre for their community. In Asia, Africa and Latin America, most are first a centre of production. Some are concerned more with the quality of production, others with the quantity. There is an oft-stated ideal of having the community garden near the centre of the community, although they are often at the edge because of land use considerations. Although many are short-lived (case 4.2), some continue for generations (photo 7.12 shows one dating to the First World War, in Zschortau, Germany).

Case 4.2 Community farming in a low-income neighbourhood of Kisangani

Backyard gardens and a community garden were started in 1978 in Matete, a low-income neighbourhood of Kisangani, Zaire. The objectives were to improve the nutritional status of the residents and increase their income.

Most community members already had household food gardens. The farmers organized themselves and solicited assistance from technical experts to improve and expand the farming activity. Technical assistance was provided by some Zambian academicians and a Zairian expert. The project stressed the use of locally available resources and sustainable farming practices.

Through collective action, the farmers were able to increase substantially their efficiency and yields. The average income of the farmers doubled in the first two years of farming. Seeds were obtained from the best plants in the gardens. Solid waste was collected and compost produced on a collaborative basis. Products were sold within the community and in nearby markets as well as consumed at home.

At a point of rapid expansion, there was some government assistance, and a local political figure came to dominate the project. He promised and delivered inputs but claimed payment for services and took credit for the accomplishments. During this time, perhaps because the farmers were disempowered, the community garden was discontinued, although home gardens continued.

Contact: Krista-Anne Rigalo, Food Activities Researcher, Mennonite Central Committee, B.P. 3101, Kinshasa-Gombe, Zaire.

Community lands are usually owned by the government, public agencies or social institutions such as schools and churches. Those used for farming may include land unsuitable to be built up, land awaiting future development, recreation areas, parks and lots left vacant after building demolition. They may be as small as 20 square metres or as large as 20 hectares.

The farming systems of community gardens are usually mixed or multicropping horticulture. But there are no inherent limits except those of space. Community gardens in larger cities frequently assist the individual farmer with access to water, security, technology, inputs, insurance and (most important) access to land. Many NGOs and municipalities charge a fee for services.

There is a significant amount of data on community and household garden farming systems. The plot holder in a community garden often can raise one-tenth to one-third of his or her family's annual vegetable consumption. Some data show that community gardeners eat more vegetables and that their families are healthier.

Schools may have community gardens; their aims include improving the nutritional status of school children and instilling in them the techniques and habits of growing what they eat. In some cultures, elementary school gardens have been particularly effective in introducing urban farming to the families of the students. In Africa, some school gardens also raise money for the school. Hospitals and churches have gardens for similar purposes.



Photo 4.2 Community garden in a churchyard in San José, Costa Rica

In some countries, including Peru, Brazil, Senegal and Indonesia, there is a new tradition of women's community gardens. Some special community gardens are extensions of communal kitchens; part of what is cooked and served to the members is what they have grown. This form has an inherent gender aspect.⁵ (Case 7.1 describes community kitchens in Peru.)

Community gardens have a long tradition in Europe and North America. They reached a peak during the Second World War with the famous "victory gardens" (see photo 3.8). They declined after the war but have enjoyed a resurgence in developed countries since the 1970s, generating newsletters, associations, technical support and recognition by municipalities.⁶

The socio-economic changes of the late 1980s in central and eastern Europe have stimulated community gardens in that region and attracted technical input from Western Europe and North America. The US Agency for International Development has also actively promoted community gardens in the region since early 1992.

Some planned neighbourhoods have community gardens designated in the initial layout. In some squatter settlements, community gardens emerge spontaneously along with the houses. Community gardens are sometimes promoted by government, as in Mozambique after independence. Because community gardens may be located on land slated for later development, they sometimes have to move, disrupting the lives of the families that depend on them.

Surplus or reserve public and private spaces

Large tracts of public or quasi-public land that is kept unbuilt for landscaping or urban extension purposes can provide significant space for urban agriculture. Examples include universities, schools, factories, churches, ports, airports, hospitals, prisons, military bases, parks and recreation areas. Putting this land into agriculture provides additional rents for the establishment as well as maintenance for the plot of land.

Public entities that have leases for urban agriculture in operation include an airport in Cameroon, the University of Manila, hospitals in Lima, a racetrack in Jakarta, the Presidio military base in San Francisco and the palace grounds in Bangkok. A golf course in Kampala ignored the presence of squatter farmers on land around the course. The golf course received the benefit of free maintenance



Photo 4.3 Maize being grown in front of a government hospital in Port-au-Prince

of the land, as the farmers kept the land weeded and slashed the areas around the plots, and therefore did not interfere with the activity.⁷

Similarly, vacant land held by large private corporations for speculation, later expansion or landscaping purposes can also be farmed (case 4.3). Such land can be found, for example, at manufacturing plant complexes in industrial zones. It can be rented out, producing an income for the owner, or made available to employees to cultivate. In Durgapur, a large planned industrial city in West Bengal, the plant managers leased land to the workers union for farming purposes and provided access to the water reservoir used for cooling the steel; workers thus could supplement food and income by gardening at the job site without spending extra time and effort to reach a distant field.⁸

Built areas that have degenerated and been abandoned can also be used for farming. Deserted sections of neighbourhoods and run-down factory buildings are examples. Such areas are usually farmed illegally or informally; in many countries, legal procedures may not exist for land agreements that can provide secure tenure to the farmer and security against squatting to the landowner.

Case 4.3 Cultivation at a large industrial site at Camaçari

The petrochemical complex COPEC, located near Camaçari in the state of Bahia, Brazil, is one of the largest in Latin America, containing several dozen factories within its sprawling confines of more than 8,000 hectares. In the mid-1980s, hundreds of hectares of land were lying fallow as "green belt" or reserve for the future.

A project was designed to put this vast wasteland to productive use for the benefit of the community.

The PRONATURA project was designed to meet several objectives: generate jobs for some of the unskilled workers who subsist on the periphery of the complex without being employed there; provide land and water for cultivation to employees and their families to enhance their income, nutrition and access to fuel; put the idle, state-owned lands to productive use while discouraging their invasion by squatters; and convert the industry's own treated waste into inputs for energy and food production.

The project foresaw multiple uses of the land: controlled exploitation of the forests; beekeeping; fish and frog breeding upstream of the complex; orchards upwind from it; and production of certain vegetables based on their sensitivity to pollutants. Some applications include using treated sludge recovered from the organic wastes of COPEC to improve certain soils; raising some energy crops (manioc and sweet potatoes) as raw materials for a micro-distillery; and recycling branches and stems of manioc and residues from the alcohol production as animal feed or fertilizer.

The integrated system was seen as a "model for the integration of agro-industrial products in conjunction with industrial complexes," exploring the links between agriculture, energy generation and environmental control.

Contact: See source listed in appendix C.

Roadsides and other rights-of-way

Roadsides and other rights-of-way are a special case of farming on public lands. Because such land is distributed in long, narrow plots throughout the urban area, farming in rights-of-way is usually on a wider scale than on other idle public lands. It can extend far outside the metropolitan area and still be part of its food-shed. Moreover, because such agricultural areas follow transportation lines, they are especially suited for intensive cultivation. Their location along the road makes taking fertilizer, water and other supplies to the garden easier. It is also simpler to market the produce. Roadside farmers can often sell their crops right on the roadside.

Other rights-of-way include a variety of transportation and utility infrastructures, especially highways, railroad tracks, electricity transmission lines, airports and seaports. The land typically is owned by a local or national government or a public or quasi-public agency. In Bombay, vegetables are grown along the entire length of the metropolitan rail system. In Rio de Janeiro, the power company leases out the land under transmission lines for farming purposes, providing the company with free maintenance of the land while preventing squatting (see case 4.9). In Europe, right-of-way farming can be found along 19th-century railroads and canals.



Photo 4.4 Roadside horticulture in a wealthy residential area of Nairobi

Right-of-way agriculture—especially horticulture and grazing—is increasing on all continents. It plays a particularly crucial role for lower-income farmers who do not have access to house yards (case 4.4). It can be intercropped or monocropped.

Right-of-way agriculture has several unique problems. Because it is principally rain-fed, it often is seasonal. Conflicts can occur between farming and traffic priorities. Because crops can be stolen, farmers tend to grow low-value crops; because they generally lack secure land title, they do little to improve the soil. Above all, the passing traffic poses the risk of lead pollution when certain crops are grown along roadways.

Case 4.4 Growing vegetables along roadsides of Dar es Salaam

In Dar es Salaam, Tanzania, vegetables can be seen growing along roadsides where strips of land have been left vacant. Roadside strips in the city are fairly wide and are kept vacant for future road expansion.

A low-income entrepreneurial farmer practises intensive, raised-bed monocropping of spinach on a one-acre stretch along the roadside, in partnership with four or five other farmers. The land was not officially allotted to them. The farmer plants seed once a week and harvests spinach daily for sale at the local market. He transports water by hand from a municipal standpipe and pays for the water on an informal basis. Composting and chicken manure are used to fertilize the soil. The farming is efficient and productivity high.

Contacts: Dr. Camillus Sawio, University of Dar es Salaam, Dar es Salaam; and L. Keith Lilley, GTZ, Arusha, Tanzania (see appendix F for complete address).

Typically, this kind of agriculture is not supported by either research or extension services, but solutions exist for many of the problems. Irrigation can be provided from streams and wastewater sources that follow utility or highway rights-of-way. Conflicts with traffic can be

resolved through negotiation and restrictions on hours of farming. Theft can be reduced through a cooperative arrangement between farmers and public and private agencies. When high-value crops are grown, a night guard is sometimes maintained.

Increases in yields through better soil management and better selection of crops require tenure security for the farmer through usufruct lease agreements negotiated with government, non-governmental organizations or farmers associations. Official rent agreements would bring some income to the city and tenure security to the farmers, increasing their efficiency. Careful selection of crops that are not susceptible to lead poisoning and monitoring of roadside farming products enable safe roadside cultivation practices and are desirable for public health reasons.

In some countries, particularly in Africa, horticultural road shoulders have been observed extending radially for 20 miles outside major cities and five miles outside smaller towns. In other countries, roadside farming is intermittent. It is usually a low-income farming activity, as higher-income residential areas tend to have home gardens.

The attitude of municipal governments towards roadside and other right-of-way agriculture ranges from forbidding it, to condoning it, to supporting it, to leasing its rights-of-way to farmers. In the planned low-income town of San Salvador in Peru, where some streets are very wide, half the roadway is used to grow fruit, vegetables and flowers. In Jakarta, farmers rent the space underneath and beside elevated toll roads. São Paulo has incorporated right-of-way farming into its long-term land use master plan. In Nairobi, most roads connecting the centre and the outskirts of the city have crops along their edges.

Because of its long-term nature, roadside arboriculture could not exist without government sanction. A few cities actually encourage the use of roadsides for fruit trees; examples include cities in China, India, Argentina and Chile. In Senegal, roadside trees and shrubs produce medicines, basket materials and fuel. In wet tropical climates, such as in West Bengal, it is common to produce both a fruit crop and a grain crop on the roadside.

The trend towards cultivation in rights-of-way (especially roadsides) is particularly strong in Africa, but it is evident in Asia and Latin America as well. In Latin America, it is most likely to occur in shantytown areas, and in Asia to be done in plastic containers. Although roadside horticulture appears to be most commonly practised by small entrepreneurs, highway and utility corporations sometimes grant larger leases to community farmers associations.

Streamsides and floodplains

Streamsides and floodplains within cities are usually not developed for built purposes due to hazard from the river. Because these areas have some of the most fertile soils available as well as proximity to water, they are well suited to farming. Streamsides and floodplains are farmed by lower-income as well as higher-income residents.

Streamside agriculture, including along creeks, rivers and canals, differs from roadside agriculture in that it is irrigated, less subject to air pollution (although water pollution can be a concern) and less subject to theft. Therefore, streamside horticulture usually has higher-value crops, is more oriented to the market than the kitchen and is given greater investment in soil preparation and terracing. Some of the outstanding examples of streamside horticulture are Baghdad, which farms the ancient floodplain with manual irrigation; Bangkok, which farms the banks of the Klong from boats and markets on the river; and Bamako (case 4.5).

Case 4.5 Cultivation in the floodplain of the Niger River in Bamako

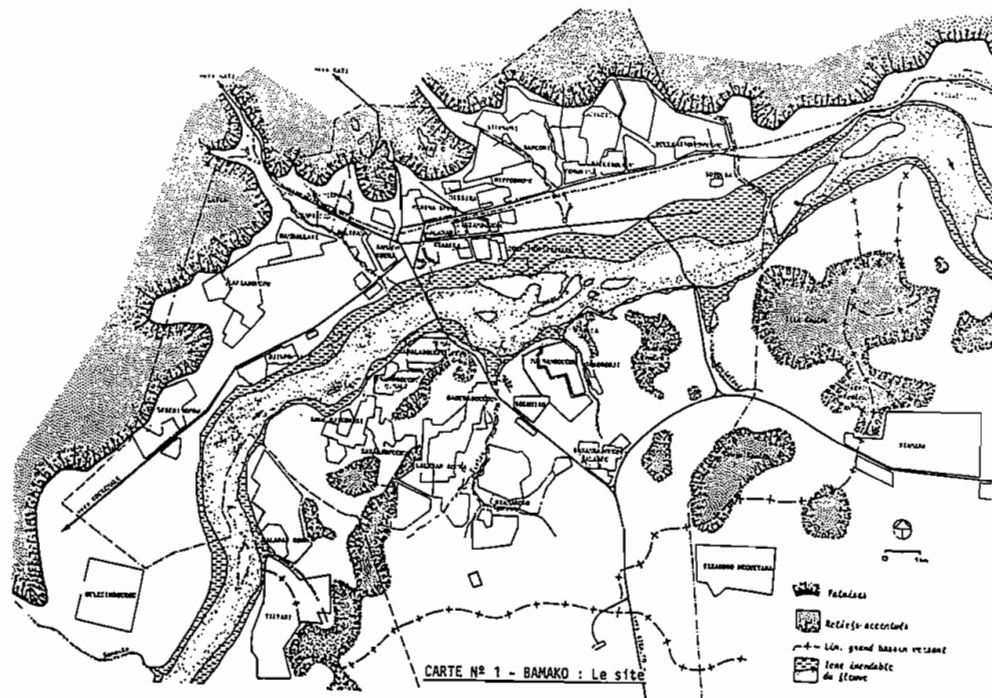
Bamako, the capital of Mali, is located on both sides of the Niger River. It has a large number of agricultural areas within its urbanized areas. One particularly significant area is the floodplain of the Niger (figure 4.1). In 1987, more than a thousand hectares of floodplain were available for cultivation. With irrigation coming from the river and fertilizer from organic urban and local wastes, a complex combination of farming systems has developed in these areas.

Kalabancoro is a peri-urban village located in this plain, upstream along the Niger River just south of Bamako. The utilization of land in Kalabancoro depends on its proximity to the river and the way it is held. Most interesting is village land located along the Niger, whose use and users change between the rainy season and the dry season. During the rainy season, rice is harvested on this land by women from the landowning families, taking advantage of the very wet conditions. During the dry season, the owners transform one portion of the land into a vegetable garden. The rest is open to the community for gardening, after the customary request for approval from the owners.

The land is at the centre of the local food production system. Surplus vegetables are sold at the market. Because of the land's special cultivability, the value of parcels located in the lowlands is much higher. Rice cultivation is conducted exclusively by older women, giving the riverside plots a unique gender role.

With the expansion of the Bamako urbanized area, conflicts over land in the area are increasing. However, most new housing construction is on Kalaban plateau, away from the river. Cultivation in the *fala* (riverbank fields) continues, partly because of the value of the land and partly because, unlike ordinary fields, these fields cannot be sold freely. The fields are in "bounded ownership", which means

Figure 4.1 Flat plain of the Niger and farmable gaps between the settled zones of Bamako



Note: The floodplain of the Niger River is marked in small horizontal dashes.

Source: S. Diallo and Y. Coulibaly, *Les déchets urbains en milieu démuni à Bamako* (Paris: United Nations University, Food-Energy Nexus Programme, August 1987), p. 45.

that the owners' property rights are acknowledged and respected by the entire community to the extent that they do not negatively affect the perceived benefits that the community accrues. The threat of ostracism by the community prevents individual members from openly selling their lands.

Contact: See source listed in appendix C.

As with roadside agriculture, legal access to the land and security of tenure are concerns. Government and NGO intervention is also just as urgent. Monitoring and extension services to prevent food contamination from polluted water are essential. Many urban streams in developing countries are no more than drainage channels or open sewers. In these sites, agricultural development must include water treatment. Alternatively, farmers can bypass the problems of pathogen removal by planting crops that are more resistant to contamination. Aqua-terra farming systems, combining land and aquatic crops and animals, are especially well suited to floodplains.



Photo 4.5 Intensive horticulture in a floodplain near the city centre of Dar es Salaam

Water bodies and wetlands

Contamination from city waste can make bodies of water dangerous for human use. Using aquatic plant and fish production for the biological treatment of the waste can mitigate this problem (case 4.6). Streams can be diverted into small sewage treatment ponds, and rivers—outside boating channels—can be tapped to transform wastewater into food for the city.

Case 4.6 Wastewater fisheries in China

Farmers in China have used solid organic wastes to fertilize farmland and fish ponds for centuries. Modern usage of municipal wastewater for aquaculture began in the early 1950s. Using wastewater reduces the cost of both fertilizer (when it is used to irrigate crops) and commercial fish feed.

Most municipal wastewater in Chinese cities is drained into various water bodies that are used as fish ponds; about 10% is used for irrigation or fertilization of land. In the fish ponds, aquatic plants (for example, lotus) remove various heavy metals and other pollutants, thus treating the effluent before it is used as fish feed. The process of fish production also reduces the pollutants in the wastewater.

Fish yields from waste-fed ponds are reported to be two to four times higher than those from normal ponds. In 1985, China produced 30,000 tons of wastewater-fed fish—1.3% of its freshwater fish production. For the cities of Wuhan and Changsha, wastewater-fed fish accounted for more than half of the fish produced that year.

Contact: See source listed in appendix C.

Bodies of water within urbanized areas—seas, rivers, lakes, canals, ponds, reservoirs—are often available for public fishing. Fishing rights

may be leased by the authorities. In addition, fish farms are an important component of the food systems of some cities, such as Hong Kong.

It is vital to maintain sizable wet areas within each metropolis in “wild” form. They are needed for natural resource conservation and regeneration; moreover, if used for habitation, they are prone to flooding. But preserving all wetlands in urban areas in undisturbed condition is nearly impossible. Frequently, poor urban residents expand into them and use them for built or agricultural purposes. In Kampala, for example, farmers drain and reclaim swampy areas in the city for the purpose of farming, without help or permission from city authorities.⁹

Several forms of aqua-terra farming can help preserve wetland biodiversity. One of the best-known examples of appropriate use of wetlands for agricultural purposes is the centuries-old *chinampas* farming system in Mexico City, which combines aquatic, tree, vegetable and flower production with recreation, tourism and trade. Equally ancient systems exist in other parts of the world. The *hortillonages* of the Somme River valley of northern France, which date to pre-Roman times, are today both an important tourist attraction and a productive market gardening district; farmers resisted built-up urban uses of the area by forming an association, improving the maintenance of their properties and increasing productivity.¹⁰ The cultivation of aquatic plants, if practised properly, can keep the wetlands from deteriorating; wetlands in East Calcutta, for example, have been converted to sewage-fed lagoon fisheries, thus maintaining the wetlands’ habitat (see case 3.5).

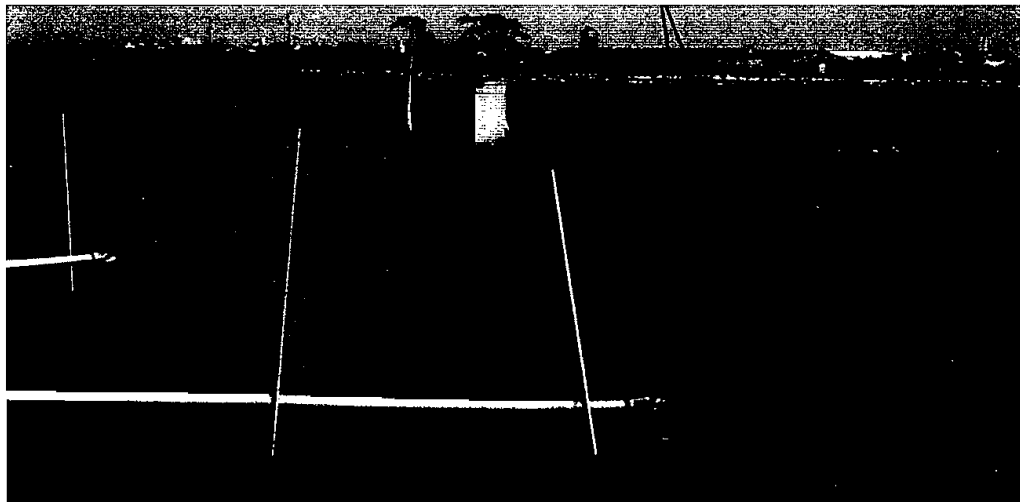


Photo 4.6 Catfish pond in urban Taiwan (province of China)

Not all wetland areas can or should be put into agricultural use. Because wetlands are extremely sensitive habitats and their biodiversity and long-term survival can suffer from hurtful practices, cultivation within them requires special care. Thus the question becomes how they can be utilized with minimal environmental damage.¹¹

Steep slopes

Steep slopes, like wetlands and water-logged areas, are difficult, expensive and dangerous to develop and service for built-up urban uses. Unfortunately, these areas are often occupied by people who have no alternative places to live, leading to disastrous effects. Deforestation, soil erosion and excess water runoff may result, leading in turn to houses cracking and sliding down hills, fires blowing out of control and lives lost.

Some types of agriculture—especially forestry and terraced horticulture—are often the best use for steeply sloping land. They stabilize the slopes, prevent erosion and absorb air pollution while providing jobs and food. The presence of tree cover improves the climate and temperature of the city. A managed forest on the slopes can also be a good source of wood, crops and animals for the needs of the city.



Photo 4.7 Mixed cropping on steep slopes outside Nairobi

Steep slopes are often among the last areas of a city to be developed for built use, and thus remain available for agriculture. Mexico City, for example, is maintaining a “green belt” on its surrounding mountains. In Kinshasa, farmers are succeeding in reforesting Mont Ngafula and earning a living (case 4.7).

Terraced farming is found in steep areas around the globe. Terracing is an ancient technique, capable of developing flat fields on slopes and increasing the soil and water retention of the land. Firm tenure arrangements are essential because of the high investment that terracing requires.

Case 4.7 Reforestation of the slopes of Mont Ngafula in Kinshasa

Farming activity in Mont Ngafula, a squatter area at the outskirts of Kinshasa, Zaire, was begun through the initiative of a horticulturist from a church group and developed through cooperation among the church, the homeowners association, the government and a research organization.

A tree nursery with bamboo and other species, used for animal feed, fruit and fuel wood, was begun with advice from the Zairian Environment Department. Training, seminars and site visits were organized for the farmers to learn more about management of the tree crops as well as how to prevent soil erosion. A committee of community members was responsible for overall planning of the farming activity to ensure prevention of soil erosion.

The project was expanded to include fish production for sale in Kinshasa. After site visits, training seminars and a demonstration pond, about 30 families began their own fishponds. Brewery waste, pig manure and leaves were used to fertilize the ponds. The project also included vegetable gardens, run mainly by the women in the community.

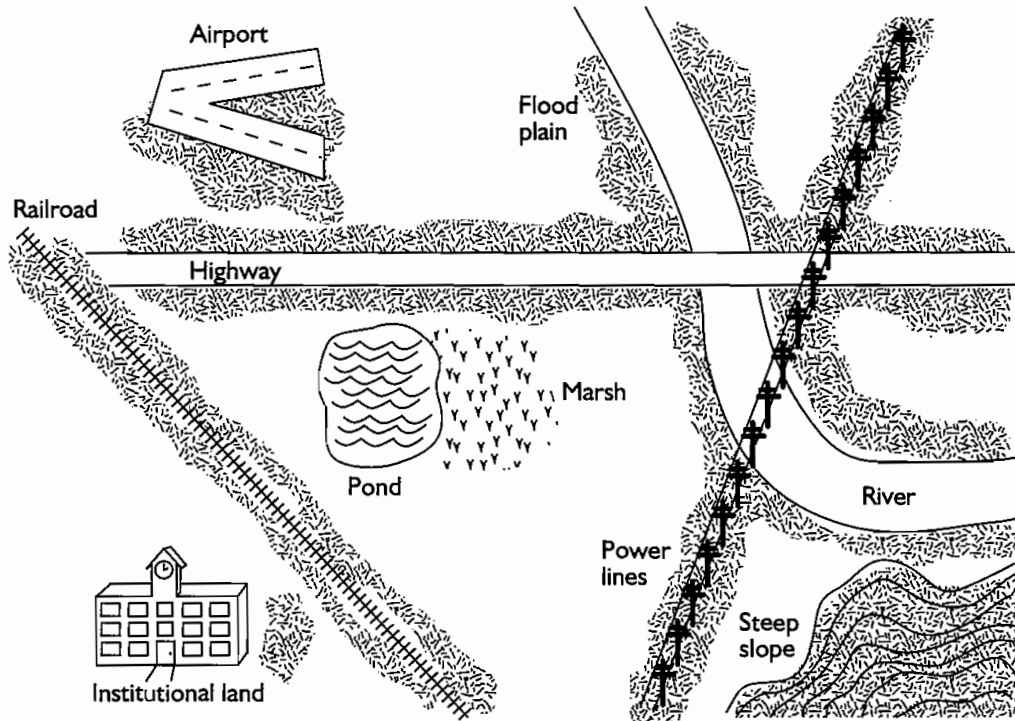
The success of the project is reflected in the monetary returns. The farmers attribute their success to the training they received; the trainers credit the farmers' entrepreneurship and native knowledge.

Contact: See source listed in appendix C.

Duration of use

The length of time that a particular space is available to a farmer significantly influences the farming activity. It affects the farmer's choice of crops, the amount of care the farmer gives to the land and the level of planning he or she undertakes. A plot may be available for permanent agricultural use, long-term use or short-term use. All three are considered here. Figure 4.2 represents schematically some of the most important types of spaces available either permanently or for a long period.

Figure 4.2 Areas suitable for permanent or long-term urban agriculture



Source: The Urban Agriculture Network.

Permanent use

Some areas are permanently available to farming because they are not suitable for built-up uses. These include water bodies, streamsides, floodplains, wetlands and steep slopes. Construction on these areas is not desirable: they are expensive to develop and service, and building on them is particularly damaging to the environment. It is therefore often worthwhile to put or keep them in productive agricultural use in concert with recreational open space activity. From the pre-Columbian civilizations' use of aquatic and marshy areas to the ancient Javanese, Chinese, and Inca mastery of intensive farming on steep slopes, many historical practices in such areas are appropriate to today's cities and are being reinvented (case 4.8 and figure 4.3).

Case 4.8 The *chinampas* of Mexico City

Integrated agricultural systems utilizing alternating raised fields and canals were developed by various cultures in Latin America in pre-Columbian times. When the Spaniards arrived in the 16th century, "floating gardens" among the waters of the five lakes of the Valley of Mexico were producing most of the food consumed by the city of 200,000 inhabitants.

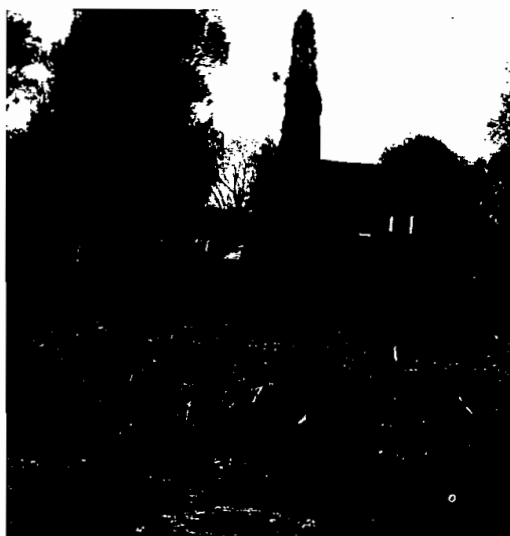


Photo 4.8 *Chinampa* aqua-terra farming system of Mexico City

A living example of these ancient floating farms is the *chinampas* at Xochimilco in Mexico City. Livestock, poultry, vegetables, ornamental plants and flowers and trees for fuel are grown on the tracts of land. Canals between the tracts provide transportation, irrigation, pisciculture, recreation and tourism.

The floating raised beds were initially created by the Aztecs by weaving thick mats of grass and other organic matter and covering them with mud from the lake. Farmers over time kept adding layers of organic matter and mud, and the floating beds eventually took root. Trees, called *ahuejote*, were planted along the sides of the beds to secure them further.

After the arrival of the Spaniards, the waters of the lakes were drained or diverted for other uses, and most of the floating farms died over time. Pablo Torres, an expert on farming systems at the University of Florida at Gainesville, found that the production of the *chinampa* per unit of space increased with the introduction of European vegetables and livestock by the Spanish. The waters for Xochimilco were also cut off over time, and urban development took over much of the area. Sewage effluent was directed into the *chinampas* canals, choking up the waters and harming the farming activity.

In 1987, UNESCO declared the area a World Cultural Heritage site, and the city began a programme to restore the *chinampas*. Wastewater treatment was introduced, raised-bed fields were rebuilt and the canals were cleared of the water lilies choking them. A flower market was built within easy access to farmers of the *chinampas*.

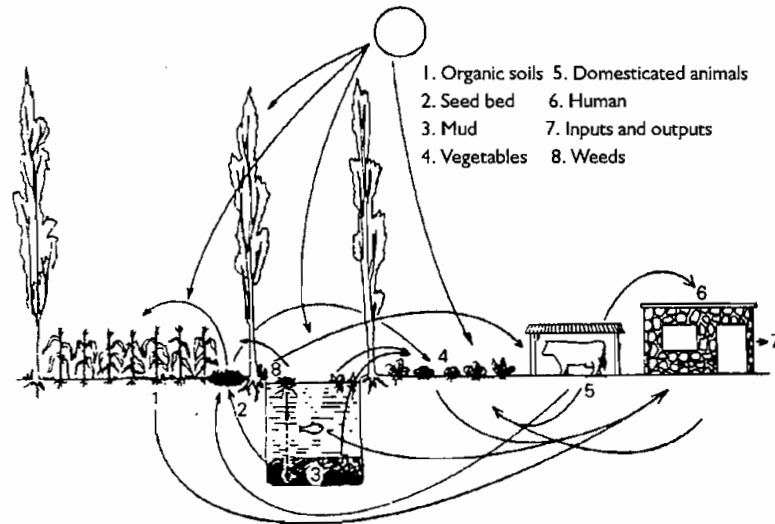
Today, hundreds of farmers are still farming the *chinampas* and making a living. Farmers are again enriching and repairing the beds by lifting mud from the bottom of the lake and spreading it on the beds.

Xochimilco is a good example of urban agriculture that combines production, marketing and recreation in its economic activities.

Contact: Alfonso González Martínez, Grupo de Estudios Ambientales, Mexico City, Mexico; Pablo Torres Lima, University of Florida, 330 U.V.S. Apt. #6, Gainesville, FL 32603 USA.

Because these unbuildable lands are permanently available public goods, it is especially important for city governments to create long-term agreements for their management and use. Since mismanagement of these resources could have environmentally disastrous consequences, greater involvement of and input from civic authorities are required. For instance, the schedule of tree harvesting on a slope may need to be regulated by a municipal agency, even

Figure 4.3 Recycling of nutrients in a chinampa



Source: Juan J. Jiménez-Osornio and others, *Past, Present and Future of the Chinampas*, Maya Sustainability Report I (Riverside, Calif.: University of California, 1990), p. 50.

though tree orchards on the slope may be owned by several private farmers.

Long-term use

Some spaces in urban areas are reserved over the longer term for other uses but have large underutilized or unutilized tracts of land that could be used in the interim for food production, biological waste processing and other activities that both enhance the environment and can provide an economic rent from the site. These idle lands, covering vast areas in many developing countries, may be public, quasi-public or private and include most community spaces, surplus or reserve lands and roadsides and other rights-of-way. The electric company in Rio de Janeiro, for example, allows farmers to use land under transmission lines (case 4.9).

Case 4.9 Cultivation under electric transmission lines in Rio de Janeiro

In Rio de Janeiro, the electric company, CERJ, makes the land under transmission lines available to farmers free of charge. For CERJ, this arrangement ensures maintenance of the land under the lines and prevents squatting. In addition, the utility buys produce from the farmers for its canteens. Of the approximately 900 hectares of land under transmission lines, 172 hectares were under cultivation in 1983, resulting in annual production worth about US\$10 million.

In the early part of the century, the land was leased out by CERJ at a charge. The initial lessees were mainly Portuguese immigrants producing for subsistence.

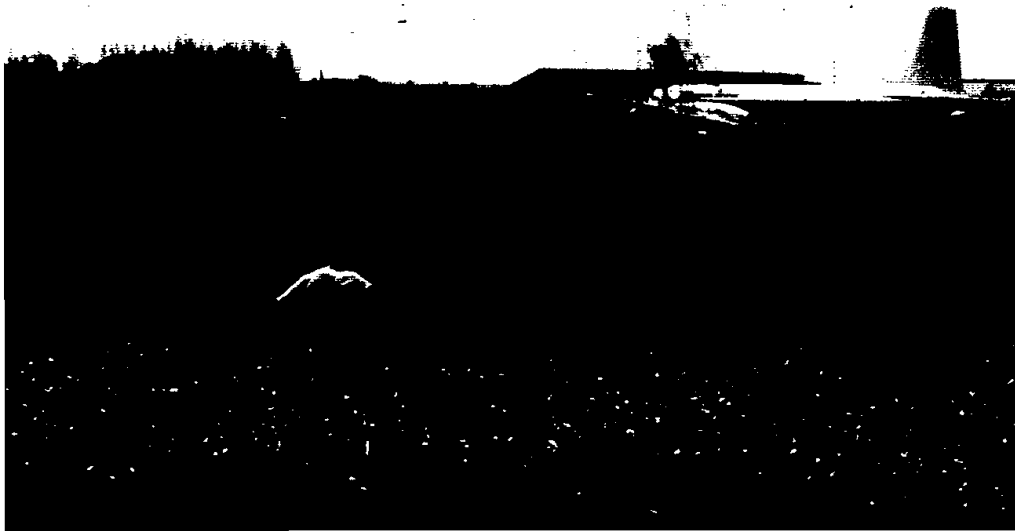


Photo 4.9 Cultivation on airport buffer land in Manila

The current mix of farmers is diverse, with a third of the farmers producing for sale. The company gives the land out on a permit or loan-contract (with no charge). These permits have clauses obligating the farmer to keep the area under cultivation, fenced in and without tall vegetation. Permits help the farmers receive credit as well as technical and training assistance from government agencies.

Farmers produce mainly vegetables, and the level of expertise and productivity is average. Under the revised form of land agreements, farming is expected to become more efficient. It also has the potential to significantly contribute to the food security of Rio de Janeiro.

Contact: See source listed in appendix C.

A change in thinking is needed for farming of such spaces to occur on a wide scale. If the question, “Why is this land not being used productively?” were asked about every vacant piece of land—both public and private—it would be possible to identify many potential agricultural areas. The use of the legal system combined with assistance from NGOs and farmers associations is crucial to more systematic leasing or renting of land and water for medium- and long-term farming.

Short-term use

The use of idle urban lands for agriculture does not have to be permanent or even long-term. As a city grows, its perimeter grows more rapidly than its built area; thus there is always new land available for the short term at the edge of the city. Moreover, because cities also tear down and rebuild older neighbourhoods, temporary sites for

urban agriculture also exist near the centre; old factory buildings, for example, can be used for mushroom and greenhouse agriculture. Land held for speculation or future use can be put into agricultural production as well, although in most countries tenancy laws work against such use and farming occurs informally or illegally.

Lack of secure tenure is a limitation to farmers, who do not know whether they will see the fruits of their efforts. However, tenure that is ensured for three or fewer seasons, whether informally or through a contract, may be sufficient (depending on the crop and the condition of the land) for a farmer to be willing to invest time, money and effort in farming the land. The case of the Matalahib gardens in Manila illustrates that interim availability of land is sufficient to encourage farming, as long as the time period is understood (case 4.10).

The concept of usufruct, essential for validating interim urban agriculture, is beginning to be accepted by a number of countries and local governments. Peru is urging public and private landowners to make "free land" available to farmers associations. The government of Indonesia and the municipality of Jakarta have a policy and program of persuading public and private landowners to make "sleeping land" productive.¹² New York City makes more than 1,000 vacant lots available to community groups through a municipal agency, Green Thumb.¹³

Case 4.10 Community gardens in Barrio Matalahib, Manila

Community gardens were started on unused and fallow land in the squatter area of Matalahib in 1980, with the assistance of two volunteer policemen. The objectives were to provide income and improved nutrition for the 2,400 residents as well as to make productive use of a degraded and squalid area that had become a site of criminal activity.

Most inputs were obtained at no cost: permission to use the land was granted by the government, seeds were obtained from discarded market vegetables and from public and private companies and water was delivered by the police department. Technical assistance was provided by the University of the Philippines at Los Baños and a non-governmental organization, the Earthmen Communications Foundation. The land was divided into small plots, which were allotted to families interested in farming it.

The programme had ups and downs, but through the involvement and enthusiasm of the community three good crops were obtained. By the third crop, the one to one-and-a-half hectare area was producing enough vegetables to supply 80% of the community's demand. Some farmers sold fresh produce on the roadside near the barrio. The physical environment of the area was considerably improved and crime reduced. The success of the Matalahib farm led the government to promote community gardens elsewhere in the city.



Photo 4.10 Vegetables growing in community gardening plots in Barrio Matalahib, Manila

In 1982, the land was sold to a private developer. Farming was abandoned even before the land was developed. Access to land has been identified in field interviews in the Philippines as one of the principal constraints to urban agriculture.

The project demonstrates the catalytic benefit that an advocating NGO can bring to a project that serves a perceived need. It also shows that urban farming has a short learning curve and rapid returns. Even though the life of the Matalahib gardens was short, the success of this case lies in the acceptance of farming as a profitable economic activity and in its replication.

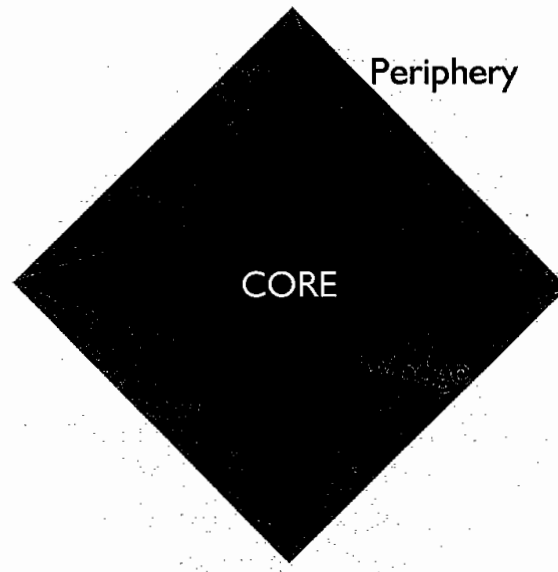
Contacts: Dr. Isabel Wade, Urban Resources Systems, San Francisco; Professor José Deanon, University of the Philippines, Los Baños; and Mario Chanco, Earthmen Communications Foundation, Manila, Philippines (see appendix F for complete address).

Location within the metropolitan area

Large cities and metropolitan areas can be divided into four main zones: (1) one or more city centres with offices and retailing activities; (2) several high-density development corridors along highways and railroads; (3) wedges of lower-density development between the corridors; and (4) an urban-rural (peri-urban) fringe area (figure 4.4).

The principal differences among these zones are the intensity and type of land use. Core zones have the highest density and the greatest mixture of land uses, followed by corridor zones. Wedges are patchy in character, and the periphery is constantly changing. Agriculture in

Figure 4.4 Four-zone model of a city



Source: The Urban Agriculture Network.

each of the four zones thus displays a particular character derived from the nature of the zone itself.

Farmers often farm in more than one zone. A household garden in the core or in one of the corridors where high-value vegetables are grown for home consumption may be complemented by a stream-side garden in a wedge or in the periphery that yields lower-value crops for sale at the market. The farming systems are chosen by the farmers for each location based on, among other things, differences in land value and risks of crop loss.

Before examining the nature of agriculture in each of these zones, it is useful to note that this is a simple model that cannot fully capture the dynamism and diversity of the world's cities.¹⁴ One analyst notes that the classic model that predicts declining land use intensity as one moves farther from a presumed central point (the von Thünen model) does not correspond to the spatial distribution of urban agriculture in contemporary cities. Many cities have a “multicentered structure” with “satellite” settlements around the core area, leaving many lower-density gaps in the urban pattern.¹⁵

Moreover, there are many exceptions to the zone model. In the *Randstad* concept of the Netherlands, for example, several large cities encircle an agricultural core. Colonial cities, especially in Africa, fea-

tured an exceptional amount of open space between the “colonial city” and the “native city”. Much of this space survives today and is farmed actively (in Mozambique, for example, a golf course was converted to rice culture). Furthermore, agriculture undertaken by urban residents beyond the urban areas, such as on the Russian *dachas*, would not be covered in this model. Despite these exceptions, and the continuously shifting line between what is urban and what is rural, the four-zone model is still useful for an examination of where agriculture takes place in the urban context.

Core

The core of a city has the highest population and building densities, with a predominance of commercial space. At the city centre and in the major nodes, urban agriculture is found most commonly on rooftops and balconies, on temporarily vacant lots, in converted buildings and in public parks. Certain farming systems and crops naturally dominate: mushrooms, pigeons, flowers and salad crops (especially for restaurants)—in other words, agriculture that has higher value and requires greater investment.

There is considerable scope for small-scale plastic greenhouse farming systems, including hydroponics. In older cities, redevelopment sites may be used temporarily for farming, with greater social and environmental benefits than the usual car parking lot. Most of this cultivation is not expected to remain for long in a specific location, due to urban renewal of the core.

In addition to these short-term uses, there is a surprising amount of permanent open spaces even within the dense fabric of cores. These usually consist of park land and of a variety of unbuildable surfaces. In particular, agriculture can be found on the waterfront and within water bodies. Cultivated areas in wetlands adjacent to the city centre can be found from Calcutta in India to Amiens in France. In Managua, unstable sections of the central part of the city were put into agricultural use following the devastating earthquake of 1972.

Corridors

Most interim farming takes place in the corridors along main roads and railway lines, since this is where most construction takes place and large not-yet-built lots are most common. The corridors have

more developed transportation infrastructure and are well linked to markets. High density of residential use also means a higher concentration of demand for produce.

As the city grows, the farming systems of the corridors become similar to those of nodes or city centres. Careful selection of pollution-resistant crops is as necessary in corridors as in city centres. Corridors are the site for ornamental horticulture, roadside horticulture and grazing, market gardening, greenhouse vegetables and flowers, and poultry and microlivestock. Farming at home is another major type of agriculture in the residential corridors. Frequently, corridor agriculture includes retail outlets (roadside stands and markets).

In many cities and towns, these corridors have low-intensity crops, recycling little waste and producing low returns on labour because the farmers are insecure about their tenure, or at least about how long they can hold onto their land. Often, the authorities perceive agriculture as an inappropriate long-term activity. Interim access to land can be efficiently brokered by a unit of local government or an NGO bringing together the owner, the developer and the farmer.

Wedges

The wedges between development corridors, together with the periphery, provide the principal areas of land for urban agriculture in most larger cities. This is the locus of milk and egg production, orchards and fish ponds. Land use is mostly a mixture of residential and agricultural, with housing gradually moving onto and replacing farmland.

Wedges are where the greatest amount of urban land not suitable for development is found, such as steep slopes and wetlands. These areas sometimes offer opportunities for specific types of urban agriculture. Traditionally, the wedges also contain low-intensity uses such as cemeteries, universities, military bases, solid waste dumps and forest parks, creating a large area of unused or underutilized land that can be put to productive use through agriculture.

Keeping wedge land in high-intensity agriculture may have a high opportunity cost (built use typically yields higher land rents than agriculture) but will successfully achieve environmental conservation. Cities in Asia, and increasingly in the rest of the world, today recognize that agriculture is an appropriate permanent or long-term use in the wedges, and that government and NGO programmes are needed to assist farmers to adapt to the urban market.

Figure 4.5 Land use map of greater Beirut, 1986



Source: Mission Franco-Libanaise d'Etude et d'Aménagement, *Schéma directeur de la région métropolitaine de Beyrouth* (Beirut: République Libanaise, Direction Générale de l'Urbanisme, June 1986).

Wedges tend to get built out over time. Nevertheless, patches, sometimes considerable in area, typically remain as the corridors push outward, providing green "lungs" within the urban fabric. These patches have different features from both the dense urbanized pattern of the corridors and the extensive transitional spread of the periphery.

Some unbuilt wedges are in the form of a ribbon. These linear strips often follow a natural element, such as a river or ridge. The plan of greater Beirut, for example, clearly shows the agricultural belt that follows, in part, the Beirut River (figure 4.5). That belt formed the periphery of the city decades ago; now it is a wedge surrounded by built-

up districts. Corridors can also be seen on the ridges perpendicular to the sea, with wedges that include greenhouses running between them.

Periphery

The periphery is the rural-urban fringe or peri-urban area that surrounds the city; it is characterized by small and medium-size farms oriented to the metropolitan market that are more diverse than those in rural areas. In the periphery, a large proportion of families have some off-farm income. Typically, the agricultural industry in this area is constantly shifting to new sites and adapting to new demands.

The size of this urban agriculture zone is largely determined by transportation efficiency and landscape features. In greater Calcutta,

for example, where transport is congested, expensive and inefficient, the rural-urban fringe may extend no farther than 25 kilometres from the centre, even though it is a city of ten million people. Manila, with a somewhat smaller population, has built express highways and has an urban fringe that extends 50 kilometres or more.

In some cases, such as the Savanna Bogotá, the peri-urban farming area is determined by the mountains surrounding the plain, although some urban farming climbs the hillsides. In some places—for example, near Nairobi, between New York and Philadelphia and in the Dutch *Randstad*—the fringe urban agriculture zones overlap those of nearby cities.

Cities in developing countries are always expanding with population and economic growth. Just as the corridors and wedges are constantly evolving, the periphery is fluid, always shifting outward. It is a transitional area, not heavily built up, and close enough to the city (based on time rather than distance) to be an integral part of its food- and fuel-sheds. Accessibility plays a determining role here. What is grown within the peri-urban area, how it is grown and who grows it are all directly responsive to the city or metropolitan market.

According to one explanation, peri-urban regions usually become zones of intensive vegetable production because of lower transport costs compared with those in rural areas, the quick commercialization needed for fresh products and higher land costs with diminishing distance from the town. The worse the road infrastructure in the region, the more intensive and the closer to the settled area the production of vegetables and other better-paying crops (such as poultry) tends to be.¹⁶

Access to land and tenure

Urban farmers around the world farm on land or in water under a variety of legal and extralegal arrangements. Some own the land on which they farm; others rent, lease or have access from a landlord that may be a private individual, public agency or the municipal or other government; most simply farm informally or illegally.

Urban farming occurs under a variety of arrangements (table 4.3). These include:

- ▼ Economic rent or lease—The farmer has official access to the land and pays rent as a share of income earned on it.

Table 4.3 Forms of land ownership and potential for farming in urban settlements

Category	Subcategory	Access	Urban farming potential
Private land	Owner-occupied	Closed. Usually strongly controlled by owner.	High. Ornamental gardening and food production. Horticulture, livestock and fisheries possible.
	Tenanted (short term, perhaps one year)	Closed. Fairly controlled by owner and tenant.	Low.
	Leased (often long term)	Closed. Controlled by owner and lessee.	Medium. Less long term than owner-occupied land.
	Illegally occupied	Variable, as is control by occupant and owner over land use.	Low unless tenure is perceived de facto as fairly secure.
Company land	Large premises	Closed. Probably strongly controlled by company.	High. Excess space can be farmed.
	Small premises	Closed. Control by business owner probably varies.	Variable. Depends on excess space.
"Public" land	State/municipal control (highways, irrigation projects, excess public space)	Often open. Control varies.	Probably high. Vacant spaces can be farmed and trees planted.
	Community land owned collectively under customary law or donated for use of local people	Usually controlled by common property arrangements.	Collective farming possible.
	Church, temple or school land	Usually controlled by common property arrangements.	Medium. Possibilities for community farming.
	Illegally occupied (may fall under any of the above categories, but most likely state or council land)	Variable, as is control by occupant and owner over land use.	Low unless tenure is perceived de facto as fairly secure.

Source: Based on E. Jane Carter, "The Potential of Urban Forestry in Developing Countries," draft (Rome: Food and Agriculture Organization, June 1993), p. 20.

- ▼ Usufruct rent or lease—Access is official and rent is decided on a usufruct basis. Examples include excess land around airports and other public facilities that would otherwise be unused.
- ▼ Farming under permit—The farmer has official access in return for maintenance of the land (for example, along rights-of-way, under transmission lines or on port authority land).
- ▼ Informal agreements—The farmer does not have official access or tenure but does have the landowner's permission.
- ▼ Unsanctioned farming—Farming occurs without the landowner's consent.

The first three arrangements—economic rent, usufruct rent and permit—are good for both the farmer and the landowner, as long as the tenancy laws ensure the rights of both. Yet much urban farming takes place under informal and illegal arrangements. In the case of public lands, most farmers are squatters. Permits for farming on bodies of water are common in several Asian countries, but less so elsewhere.

In a survey of urban farmers in Nairobi, half were farming on public land, one-quarter on their own land and one-quarter on land owned privately by someone else.¹⁷ Most of the third group were farming informally or illegally (without the owner's consent). Typically, public land was simply occupied, without permission granted or rent paid.

A survey in Kampala found that 60% of the farmers used public land, 33% were farming their own land and only 3% farmed land owned by another private individual.¹⁸ Of those using public land, 65% had no formal agreement. Only 10% of the surveyed farmers held secure tenure to the land they farmed, and 40% could be considered squatters. The survey also found tenure security to be most lacking for lower-income farmers.

There are many examples around the world of permits or leases arranged between local governments, large corporations or national government departments, on the one side, and NGOs, cooperatives or farmers associations, on the other. The use of the land for a limited purpose and time is sometimes assigned by one entity to another. The organization managing the farming then in turn may lease certain limited rights and space to individuals, families or small groups. Thousands of farmers operate in this way on the garbage dumps of Calcutta and in many other cities. In such arrangements, the owner benefits from maintenance of the land and in some cases has other

“good-will” benefits, including employee well-being, improved relations with the community and protection from competitors for the land.

Public land management becomes more efficient where agriculture is considered one of the permitted land uses. Since much urban agricultural use of land is shifting or usufruct, agreements are required that provide security to both the landlord and the farmer.



There is seldom a lack of space, land or water bodies to farm in urban areas. The problem lies in gaining legal access and secure tenure to farm this land and water. Once the entire urban sphere is explored for potential surfaces for farming, and the appropriate arrangements are worked out to permit such an activity, the next question is, “What can be grown or raised, and how?” The alternatives are examined in chapter 5.

Notes

1. Alain Bertaud and Bertrand Renaud, *Cities without Land Markets: Lessons of the Failed Socialist Experiment*, World Bank Discussion Paper 227 (Washington, D.C.: World Bank, 1994).
2. Friedhelm Streiffeler, “General Principles and Approaches for Sustainable Urban Greenbelts with Special Reference to Africa”, Technical University of Berlin, Department of Rural Sociology, 1993, p. 9.
3. Isabel Wade, “Community Food Production”, *Food and Nutrition Bulletin* 9, no. 2 (1987): 29–36. She compares three community garden programmes in Asia, Africa and Latin America.
4. Stephen Kinzer, “Dread of Builders in a City Woven with Gardens”, *New York Times*, 18 February 1994.
5. School gardens have been supported in Asia and Africa by the Asian Vegetable Research and Development Center (Taiwan, province of China) and in Asia and Latin America by the International Institute for Rural Reconstruction (Philippines). *Comedores populares* gardens are being supported by CARE, HUFACAM in Peru and others.
6. For a history of community gardening in the United States, see an unpublished 1980 paper by Thomas J. Bassett, “Vacant Lot Cultivation: Community Gardening in America, 1893–1980”.
7. Daniel Maxwell and Samuel Zziwa, *Urban Farming in Africa: The Case of Kampala, Uganda* (Nairobi: African Center for Technology Studies Press, 1992), p. 36.
8. Jac Smit, *Durgapur Structure Plan* (West Bengal: Government of West Bengal, India, 1968).
9. Maxwell and Zziwa, *Urban Farming in Africa*, p. 38.
10. Brochure of the Association pour la protection et la sauvegarde du site et de l’environnement des hortillonnages.

11. Daniel Maxwell, personal communication, 1993.
12. Buku Panduan, paper presented at a seminar on urban agriculture organized by the Indonesian Agronomists Association, Jakarta, 30–31 August 1991.
13. Green Thumb, *Annual Report* (New York: Green Thumb, 1993).
14. Socio-economic models can complement this spatial model.
15. Streiffeler, "General Principles and Approaches for Sustainable Urban Greenbelts", p. 8.
16. Streiffeler, "General Principles and Approaches for Sustainable Urban Greenbelts", p. 23.
17. Donald Freeman, *A City of Farmers: Informal Urban Agriculture in the Open Spaces of Nairobi, Kenya* (Montreal: McGill-Queen's University Press, 1991), pp. 71–72.
18. Maxwell and Zziwa, *Urban Farming in Africa*.

Producing food and fuel in urban areas

Urban agriculture includes many diverse production systems, with their various processing methodologies and marketing procedures. There is considerable linkage among these systems, with the waste of one typically feeding another.

In Mexico City, for example, sewage is used to irrigate and fertilize alfalfa, which is sold as feed in grocery stores to small producers of guinea pigs and rabbits, as well as to cattle growers. The small-livestock producers barter their manure to vegetable and flower growers, who mix it with compost made from household and street waste. Thus the waste stream is transformed into food and beauty while supporting five different farming systems: fodder, cattle, small livestock, vegetables and flowers.

Although urban agriculture varies widely from continent to continent, from country to country and even from town to town, it can for purposes of discussion be divided into five broadly defined farming systems: aquaculture, horticulture, animal husbandry, agroforestry and other urban farming activity. The categories used in this chapter do not correspond precisely to any classification of farming systems taught in agricultural schools. But they do reflect the authors' field observations.

The classification presented here is based on a mix of crops, general farming practices and specific farming techniques (table 5.1). This mix does not necessarily reflect the dominant farming systems; it also responds to the need for crops and possible methods. The great variety in what is produced by urban farmers still leaves room for further innovation and adaptation, and agricultural research centres and extension services could play an important role in increasing the appropriateness of the farming systems and techniques to the specific urban context of each city.

Table 5.1 Farming systems common to urban areas

Farming system	Product	Location or technique
Aquaculture	Fish and seafood, vegetables, seaweed and fodder	Ponds, streams, cages, estuaries sewage, lagoons, wetlands
Horticulture	Vegetables, fruit, compost	Homesites, parks, rights-of-way, roof-tops, containers, hydroponics, wetlands, greenhouses
Livestock	Milk and eggs, meat, manure, hides and fur	Zero-grazing, rights-of-way, hillsides, coops, peri-urban, open spaces
Agroforestry	Fuel, fruit and nuts, compost, building material	Street trees, homesites, steep slopes, vineyards, greenbelts, wetlands, orchards, forest parks, hedgerows
Other	Houseplants, medicine, beverages, herbs, flowers, insecticides	Ornamental horticulture, roof-tops, containers, sheds, beehives/cages, greenhouses, rights-of-way, urban forests

Source: Compiled by The Urban Agriculture Network from various sources.

Indeed, in the past couple of decades, there has been a resurgence of small-scale private research into some urban farming methods, such as biointensive raised-bed gardening, shallow-bed gardening, vermi-composting, zero-grazing, small-scale wastewater-based aquaculture and hydroponics. Nevertheless, only a few subsystems of urban agriculture, such as chicken and egg production, have benefited from long-term public and private research and development. In most sectors, the special requirements of urban cultivation have received little attention.

It is important to remember that urban agriculture produces fuel and other products in addition to food. For instance, fuel briquettes are produced from wood, cow dung and other agricultural by-products, such as the husks of cashew nuts (in east Africa) and coconuts (in east India).

Although there are some exceptions, there appear to be patterns in the scale at which various kinds of farming are practised. Roadside cattle grazing and vegetable farming systems are predominantly small operations. Urban aquaculture, poultry farming and orchards are dominated in most countries by medium to large operators. The latter tend to be capital-intensive and to have some economies of scale, leading to an important role for cooperatives.

The patterns described in this chapter are not exclusively urban: many of the farming methods also show up in rural areas. Rather, all are especially appropriate to urban situations in developing countries.

For instance, in growing vegetables, freshness of the product is critical; therefore, rapid access to the urban market, combined with the intensity of the cultivation, makes horticulture an especially important part of urban agriculture.

Aquaculture

Aquaculture includes fish crops of all types as well as many vegetable crops. It takes place in manmade tanks or in ponds, lakes, rivers, estuaries and bays from tropical to temperate climates. Hong Kong, the world's densest city, produces 40% of its demand for fish.¹ Calcutta raises one-fifth of its fish demand in sewage-fed lagoons.²

Urban aquaculture offers several specific possibilities for the world's cities and the global environment. Fish and water vegetables can be raised in wastewater purified less completely than needed for direct human consumption. Furthermore, in many cases, the process of raising these crops purifies the wastewater to a cleaner state than some current sources of potable water.

Urban aquaculture can be undertaken in water bodies not in current productive use, many of which are publicly owned. It is also compatible with many recreational uses of these water bodies. Raising fish and crustaceans in urban and peri-urban water can be an economical complement to ocean fish and rangeland meat, conserving the global ecosystem as well as reducing consumption of energy for refrigeration, transport and storage.

Aquatic plants

Water spinach, water cress, water chestnuts, lotus stems and various so-called seaweeds are common low-cost foods in Asia and Africa. Water spinach is a leafy water plant grown in marshy areas and on streamsides in India, southeast Asia, Taiwan (province of China) and southern China. It is consumed as a vegetable and used as feed for livestock and fish. It takes root easily, requires little weeding and can be harvested whenever wanted. In Hong Kong, with heavy application of treated night soil, yields up to 90,000 kilograms per hectare have been achieved.³

Floating aquatic plants such as duckweed and water hyacinth have considerable potential to provide feed for livestock and to serve as

a base for compost and fuel. When raised on wastewater, they offer a biological sustainable solution to the problem of urban water pollution. These plants grow by drawing nutrients from the rich sewage, especially nitrogen and phosphorus, in the process cleaning the water. The plants can then be fed to livestock or to fish in the pond, and the nutrients are thus recovered. The purified water can be recycled into other uses, including irrigation and groundwater recharge (case 5.1).

Case 5.1 Wastewater purification using duckweed

Duckweed grows well and quickly in many ecoclimates, in temperatures ranging from 15 to 30 degrees centigrade (photo 5.1). It doubles its wet weight in two to four days—with yields per acre as much as ten times those of soya beans. Dried duckweed has about the same amount of protein (35–50%) as soya bean.

Duckweed has many uses. It has been used for wastewater purification in the United States since 1985; it is also used as fish feed and sold as a cash crop. Israel exports the weed as a salad crop to European health food stores.

The wastewater purification capabilities of duckweed come from its rapid breakdown and consumption of excess nutrients in wastewater—mainly nitrogen and phosphorus—while it grows and multiplies. In experiments conducted in Bangladesh by the Prism Group (a US non-profit organization), wastewater from the Kumudini Welfare Trust Complex, channelled into the duckweed farms, was purified completely in 20 days, coming out with less than 0.5 milligrams of nitrogen and phosphorus per liter.

In the United States, the Lemna Corporation has nine facilities purifying wastewater with duckweed; the process offers savings of 50–75% over competing technologies. Lemna is also treating waste in Torreon, Mexico, and plans to do so in Egypt as well.

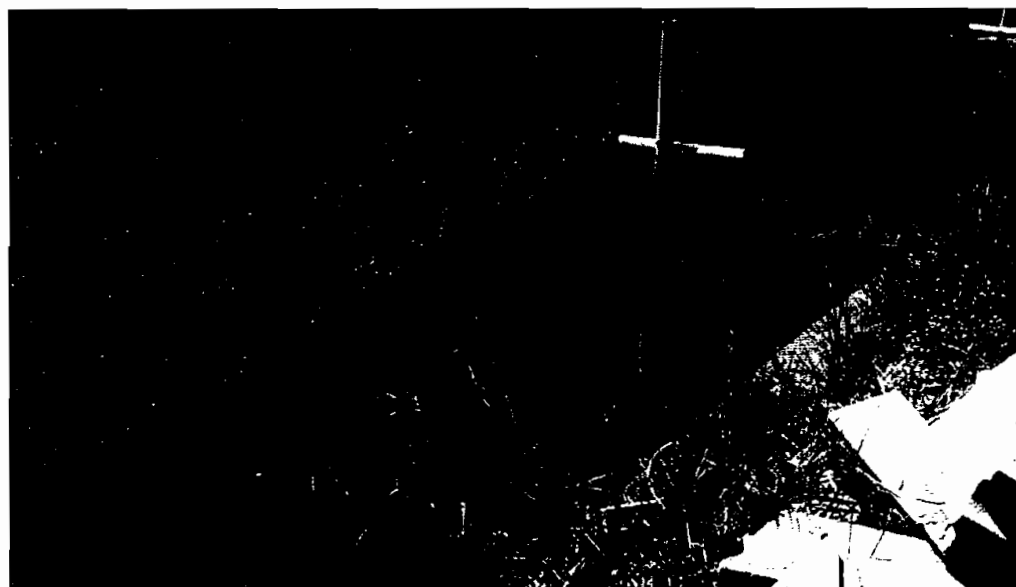


Photo 5.1 Duckweed cultivation at the Asian Institute of Technology, Bangkok

Other aquatic plants, such as water hyacinth, have similar water purification properties. However, duckweed has the advantage of being commercially much more valuable as a crop. In experiments conducted by the Prism Group and the UN Capital Development Fund in Bangladesh, duckweed farmers are harvesting about one ton per hectare per day—making more than US\$2,000 a year. Duckweed is sold as a high-protein animal feed, much cheaper than its substitutes.

As fish feed, duckweed can triple the yield of fish over unfed ponds. The experiments in Bangladesh with feeding duckweed to fish yielded an average ten tons of fish per hectare per year (the Bangladesh average is 400 kilograms)—generating a gross profit of US\$16,000 a year.

Contact: William Journey, Aquasan, Fairfax, Va. 22032 USA.

Fish and other seafood

In addition to fishing in open public waters, urban residents engage in urban pisciculture, breeding and producing fish and other seafood in controlled environments in ponds or in cages in rivers or lakes within metropolitan areas. In Jakarta, for instance, the city's reservoir is leased to fish farmers, and a hectare of water produces the same income as a hectare of land.⁴ And in Panama, one small farmer who had a series of four quarter-hectare ponds raised tilapia, carp, shrimp and native fish for separate urban markets, all fed by waste from pigs and poultry (photo 5.2).

In West Bengal, including greater Calcutta and several smaller cities, yields of fish increased sixfold during the 1980s, primarily in manmade tanks and in wastewater-fed lagoons.⁵ In Hong Kong, fish are raised in small tanks with fences around them (providing



Photo 5.2 Integrated fish cultivation near Panama City

open space in the centre of high-density residential areas), and in cages in the bays and lagoons. Some of the floats suspending the cages are used as the foundation for vegetable and chicken production. Experiments in Peru have shown sewage-fed aquaculture to be promising (case 5.2).

It appears that, globally, fishing is by custom a male occupation, even in countries where women are traditionally accountable for food production. This is, however, less true of urban pisciculture, particularly when small in scale. Because pisciculture is typically a high-capital farming system, poor farmers generally are precluded from participating, although there are some exceptions; the Jakarta reservoir and the fishermen cooperative at the sewage lagoons in Calcutta, for example, offer opportunities to lower-income farmers.

Case 5.2 Sewage-fed aquaculture in San Juan, Lima

Sewage-fed fish are commercially produced in China, India, Viet Nam, Germany, Hungary and elsewhere. In most of these places, this farming activity is long-established (see case 2.6).

Reuse of wastewater is especially important in arid Peru. The San Juan de Miraflores complex in Lima was created as an experimental facility to optimize reuse and recovery of wastewater. The stabilization ponds complex has been processing wastewater drawn from the neighbouring communities of about 150,000 residents since 1969. It processes the sewage to provide the communities with treated effluent for use in horticulture and silviculture. The communities use the wastewater (legally and illegally) to irrigate crops like corn, alfalfa, fruit and nut trees and vegetables including sweet potatoes; to water woodlands; and as drinking water for livestock.

In 1983, aquaculture was initiated by the Pan American Centre for Sanitary Engineering and Environmental Sciences (CEPIS) as a demonstration project to test the possibility of producing fish in mature wastewater stabilization ponds. With World Bank support, CEPIS undertook research to examine both the productivity of the fish culture and any associated economic and public health aspects.

Nutrients in wastewater are beneficial for the growth of fish. However, fish rarely survive in untreated wastewater. Even when fish do survive they may contain pathogens, chemicals or heavy metals that make them unsuitable for human consumption. The CEPIS/World Bank-funded experiments confirmed the absence of pathogens, heavy metals and pesticides in fish from the wastewater stabilization ponds. The study established that tilapia and carp grown in partially treated city wastewater are suitable for human consumption. The productivity of the waste ponds compares well to high-rate tropical fish ponds using expensive feeds.

Thus commercialization of the aquaculture is a possibility. CEPIS is also conducting socio-economic studies to establish the size of the market for the fish. City authorities hope to replicate the experiment at San Juan in other parts of Lima.

Contact: Carl Bartone, World Bank, Washington, DC; and Dr. Julio Moscoso Z., Aquacultura Servicios S.A., C.P. 4337, Lima 100, Peru.

Horticulture

The intensive production of vegetables and fruits (including market gardening) is both the most common and the most varied urban agricultural system. Urban horticultural production takes place on all continents of the developing world. Farmers range from the poorest slum dwellers growing a few tomatoes on some space around the hut to large agribusinesses.

Urban horticulture consists of a vast variety of crops, depending on local tastes. A growing trend is the use of plastic-sheltered cultivation, which provides protection from cold, rain, wind, sun, birds and insects. Urban crops generally are perishables, high-value crops or specialty market crops. Some special horticultural crops are discussed at the end of the chapter.

Household gardening is the most common form of urban horticulture. However, its incidence varies from city to city and country to country. Evaluations of household gardens in the Philippines by the International Institute of Rural Redevelopment found that a family could feed itself from an 80-square-metre plot in a tropical climate, using intensive horticultural techniques such as those researched by the Asian Vegetable Research and Development Center and others.⁶ High-value crops in some cases can fulfill a minimum living standard for a family on 160 square metres, providing food and other essentials.



Photo 5.3 Community garden at the Presidio military base in San Francisco, an example of consumption-oriented horticulture



Photo 5.4 New onions and maize, Pikine, Dakar, an example of income-oriented horticulture

A study in Java by the Food and Agriculture Organization found that intense multicrop household gardens produce three times the monetary value per unit of land as three-crop rice farming.⁷ The multicrop model generates crops every week of the year. In part, this is accomplished by operating on four layers—on high trees, on low trees and bushes, at ground level and at root level. The crops grown include vegetables, fruit, culinary herbs, medicinal herbs and flowers. This “layered horticulture”, used in Java and other Pacific islands, is also found in West Africa.

Streiffeler notes that “mixed cropping can be an effective use of limited space, especially if the plants have different nutritive requirements.” It also spreads “the risks of climate and attacks by insects, fungi and so on.”⁸ Mixed cropping is especially suitable in tropical climates (case 5.3).

Household horticulture is primarily for consumption by family and neighbours. However, there are exceptions. Thousands of dollars annually are generated annually by families in Thailand who grow orchids on their verandas. Housewives in Latin America produce chilies and market homemade salsa. Lettuce grown on rooftops is sold directly to supermarkets in Bogotá.

Case 5.3 VAC yard horticulture in Viet Nam

Farmers in Viet Nam are increasing the productivity and sustainability of their back-yard farms with help from the Vietnamese Gardeners Association. The association is promoting VAC—a process of mixed cropping that provides crops with improved nutrition, nourishes the soil and provides cash crops. The VAC programme is partly sponsored by UNICEF and promotes integrated farming of vegetables, pigs and fish.

A farmer in Xuan Phuong, outside Hanoi, is growing vegetables in his 720-square-metre front yard for direct marketing in the several open markets of Hanoi. The yard grows grapefruit, oranges, bananas, papayas, sapodilla, mint, squash, onions, amaranth, protein-rich saupous and sweet potatoes. The plants grow at different levels and heights, providing shelter, shade and nutrition to each other. The leaves of some plants are fed to pigs, while other parts—such as the roots of sweet potatoes—are for human consumption. The yard is fertilized with pig manure and human waste.

The farm includes a small fishpond that has about 1,500 fish. Species are carefully chosen to be symbiotic. Tench tend to feed near the top of the pond, carp in the middle and tilapia at the bottom—feeding on the waste of the fish species living above it. The pond is covered with water hyacinth, which provide oxygen for the fish, protect them from the sun and are used to feed the pigs. The yard also has a pigsty with a sow that produces up to 20 piglets a year. Yard greens and fish-laced meal are served to the sow.

In 1992, one farmer using the VAC system made about US\$450 from his yard. (The average Vietnamese annual income is US\$240.) UNICEF estimates the income of VAC farmers to be from three to ten times higher than that of rice farmers.

VAC gardens are also established by schools, churches, orphanages, old-age centres and factories in Viet Nam, providing their users free or subsidized nutritious food. The gardeners association has a corps of extension workers who are experts in the various technologies and farming systems and who provide extensive and regular advice to the VAC farmers.

Contact: Dr. Vu Quyet Thang, CRES, National University, 19 LeThanh Tong, Hanoi, Viet Nam.

Families that do not have a garden in their home can practice horticulture in community gardens or on plots located at the city's edge or beyond. The best known such example is the Russian *dacha*, or small plot of land, reached within a couple of hours by train from the city centre; *dachas* have evolved from being principally a form of recreation to becoming essential to the well-being of millions of urban Russians.

To previous generations in Europe and North America, urban horticulture may have been synonymous with "market gardening". In some places, it still is. The intensive production of fruits and vegetables in peri-urban areas by medium and large growers is common where transport costs are high and where governments recognize its

value. Thus market gardening is common along the rail lines at the edge of both congested Bombay (with no government support) and Tokyo (with government subsidy). New Jersey, where most of the population is urban or suburban, is still referred to today as the Garden State; it produces fresh vegetables and chickens for the New York and Philadelphia metropolitan areas.

Market garden crops differ from rural crops in that they are planted in direct estimation of weekly market prices and are produced because the farmer is located near a market, not because the climate and soil are necessarily best suited for the particular crop. Market gardening can be distinguished from household consumption-oriented gardening in that it is larger in scale, predominantly engaged in monocropping and solely market oriented.

Market gardeners are usually among the wealthier farmers and sometimes are corporate. They rely more on hired staff, and many have professional managers. Nevertheless, small-scale low-income market gardeners form a significant population with a large productive capacity in poorer cities such as Bamako, Mali, and La Paz, Bolivia.

The negative impact of market gardening on the environment can be significant. Monocropping and the heavy use of fertilizer and insecticides are common in market gardening, and these can lead to unsafe food, soil contamination and loss of fertility. Market gardeners often organize to enhance their preproduction, production and postproduction capacities. In some locales, for example, Taiwan (province of China), market gardeners have an information and technical assistance system established in cooperation with government. Farmers cooperatives provide extension services, inputs, credit and marketing assistance.

Some horticultural practices, such as container horticulture and soilless horticulture, are particularly relevant in the urban context.

Container horticulture

All that plants need to grow is light, water and a medium in which to take root. Thus plants can be cultivated in a variety of containers—boxes, rain gutters, pots, used tires, even plastic bags—that can be placed in a variety of locations, including patios, balconies, open stairwells and flat roofs.

Restricted land space in high-density quarters encourages container farming systems. In Mexico City, a typical field crop such as potatoes



Photo 5.5 Container gardening in Santiago

is grown in stacked used truck tires, producing a vertical cylinder of potatoes. In Santiago, Chile, the Centre for Education and Technology has a 20-square-metre demonstration city garden plot. The researchers make the most of the small space by planting crops in containers stacked in pyramids (photo 5.5). Plants grow on the walls and the same vines that provide a ceiling of shade also provide crops. By using containers, walls and even air space, 20 square metres provides twice that much productive farm space.

Container farming has both the usual concerns related to agriculture (access to water, to credit

and marketing) and its own special technical requirements. During the 1980s, container agriculture became a sustainable source of food security and income for an increasing number of low-income farmers. In the area of ornamental horticulture, it has also become a viable middle- and high-income farming system. The use of plastics for all kinds of containers has expanded dramatically, making them more readily available than traditional pots made from clay or expensive cloth.

Container farming is popular worldwide. Growing cactus in a box and houseplants in plastic pots on the roadside was mentioned earlier. In Hong Kong, vegetables are grown in containers that rest on top of the floating cages used for raising fish. In Old Delhi, silk-worms produce yarn in boxes on verandas.

Soilless horticulture

Another urban horticultural practice is soilless farming. Several forms of horticulture do not use, or at least do not require, soil. The simplest example are crops grown directly on solid waste or compost without soil, as is practised in Port-au-Prince and elsewhere (case 5.4).

Shallow-bed gardening is a technique that can be used to grow crops intensively on rooftops and other non-fertile surfaces. It is useful for people who do not have land space on which to grow crops and for those dealing with contaminated urban soils. Although shallow-bed gardens need more frequent watering and care than plants grown on land, if the gardens are kept well watered and nutrients are maintained, the roots do not need soil. Even crops that on land send their roots deep can be grown in shallow beds.

Case 5.4 Shallow-bed gardening on inner-city rooftops in Port-au-Prince and Saint Petersburg

Educational Concerns for Hunger Organization, a US non-profit organization, promotes rooftop shallow-bed cultivation among low-income residents in several locations, lately Port-au-Prince, Haiti, and Saint Petersburg, Russia. In Haiti, the method has been particularly successful on the roof of a hospital and on paved patio surfaces. In Saint Petersburg, along with a number of high-rise apartment buildings, a prison presents an outstanding case.

In Port-au-Prince, the shallow-bed garden is made up of a three- to six-inch-deep bed of compost, four to five feet wide and several feet long. Fresh organic matter (consisting of wood chips, grass clippings, bagasse, rice hulls, corn husks and so on) is used where compost is not available.

In Saint Petersburg, local peat is used. The individual seedling is planted in a liter or two of soil set into the organic waste growth medium. Soil is not added to the bed. The compost has all the nutrients required, and soil adds weight that could cause structural problems on rooftops. The beds do not usually need a base or sides built: the bags of peat are simply opened and used as containers. One farmer has set up a vermiculture operation in the basement to generate worms to make the cultivation more effective.

Pollution of the food by the environment is one of the fears that constrain the expansion of shallow-bed farming in town. Tests carried out by the Russian State Committee on Standards showed almost identical results to those of Cornell University in New York: produce grown on rooftops contained up to ten times less contaminants than produce bought at local markets or grown on suburban plots.

Contact: Martin Price, Educational Concerns for Hunger Organization, North Fort Myers, Florida USA.

Market crops can be grown in rooftop shallow beds in the heart of the city to supply fresh vegetables to apartments, restaurants and the market. Plants that can be grown include broccoli, cabbage, peas, beans, onions, tomatoes, herbs, corn, eggplant and flowers. Pumpkin and watermelon vines can also be grown, the vines flowing out of the bed. Root crops are not suitable for shallow beds.

UNICEF used shallow-bed horticulture successfully in the villages and towns of Ethiopia during the 1980s. In Texas, tomatoes are

“traditionally” grown at home in a bale of straw. In the South Bronx, in New York City, shallow beds were built of plastic placed over contaminated soils, and the vegetables were judged safe by New York State inspectors.

The most important form of soilless horticulture is *hydroponics*, a decades-old technique whose importance expanded significantly in the 1980s. Developed in Europe and North America as a capital-intensive farming system, hydroponics has been modified in a few developing countries to be a low-capital, high-labour “popular” system (case 5.5).

Hydroponics is a plant-feeding technology in which plants are grown in an artificial soil medium (sand, gravel, cinders) or float in water with minerals and nutrients, as required. Hydroponic farming is highly resource efficient, using one-tenth or less water than field crops. Crops can be fed by hand or through a pump. Its low usage of water makes this technology especially useful in areas with water shortages.

Case 5.5 Farming without soil: women’s hydroponic cooperative, Jerusalem, Bogotá

A cooperative of more than 100 low-income women in Jerusalem, on the outskirts of Bogotá, produces hydroponic vegetables (up to 30 different varieties) on contract for a supermarket chain supplying metropolitan Bogotá. The production, on rooftops and other household surfaces, has been in existence since 1985. Technical assistance has been provided by Centro Las Gaviotas, which developed the technology in Bogotá, with funding from the UNDP office in Colombia and later through the supermarket chains.

The women in the cooperative earn up to three times more than their husbands earn in semi-skilled jobs. They produce all their own inputs except seeds, which are imported. The crops are of a good quality. Overripe or less-than-perfect crops are consumed by the farming family or fed to microlivestock.

The technology of hydroponics has received much attention. The technology from Bogotá was transferred to the Dominican Republic, Venezuela, Nicaragua and Chile.



Photo 5.6 Hydroponic cultivation for the market in Jerusalem, Bogotá

In Bogotá, however, the project has suffered since the assistance ended; dependency on nutrients supplied by the project is one of the key problems faced. For this reason, the technique was sustained only where groups of farmers experimented with locally available resources for making nutrient solutions.

Contacts: Dr. Jorge Zapp, consultant to UNDP, Bogotá, Colombia (see appendix F for complete address).

Hydroponics has two great advantages in low-income urban situations. First, it is virtually safe from water and land pollutants. Second, since the production is soilless and in some form of container, it does not depend on land space; plants can be grown anywhere, including the roof of the market. Consumers benefit from a fresher and purer product.

Hydroponic horticulture requires a great deal of organization to be established as a viable commercial farming system. Some inputs (for example, seeds and fertilizers) may need to be imported, or a new local production system may need to be set up. And because each crop requires careful tailoring to the local climate, good collaboration among farmers, technical experts and marketers is needed.

Animal husbandry

The husbandry of animals, including birds, is a common type of farming in a number of towns and cities. Nevertheless, little research has treated this common practice distinctly from the rural raising of animals. Low-income urban livestock farmers, in particular, receive little advice or assistance, including veterinary services, that is attuned to their special problems.

Urban livestock rearing is practised by both large and small producers and high-income as well as low-income farmers. The large producer may be a poultry farmer with thousands of birds, cold storage facilities, purchasing agreements for large amounts of feed and specialists on staff. The small producer might have a small herd of goats or a few pigs and some agreements about access to grazing land or access to market or restaurant waste.

The range of livestock raised in cities includes chickens, pigs, cows, goats, guinea pigs, rabbits, ducks, geese, pigeons and hybrid members of the rat family. Sometimes the animals' presence is not apparent, since they are raised in backyards and their food is brought to them there.

Animal husbandry generally has a main product (meat) and a number of useful by-products, including milk, eggs, fur, hides, feathers and dung. In Hindu and Buddhist countries, and for many poor families elsewhere, some of these by-products are more important than the meat. The animals are often treated by the poorest as insurance: they are sold in an emergency as a source of quick cash.

From sheep grazing in the park to pigeons flying over rooftops to guinea pigs squealing in cages on shelves, rearing animals offers multiple benefits to many in the city. First, family nutrition is improved through fresher, better protein; animal husbandry is an efficient way for a poor family to obtain expensive meat protein and fresh dairy products. Second, refrigerated shipping is not needed, reducing energy use, pollution and traffic. Third, grazing livestock along roadsides and on public park grasslands is an environmentally sound method of maintaining urban open space that reduces or eliminates costs. Finally, although livestock in the city may initially seem dirty, in fact animals are efficient recyclers and, with a bit of management, can improve the soil and thereby the environment.

Some concerns of those who resist urban livestock are valid. Raising animals in congested quarters in proximity to (or in the midst of) homes and workplaces can cause a variety of genuine problems: disease, overgrazing, unpleasantness (dung on the sidewalk) and contamination of water sources. Simple regulations and monitoring are therefore vital to ensure appropriate animal husbandry practices in urbanized areas.

Poultry

Urban poultry production has an important role to play in the future food supply of the world's cities. It is growing fast and varies considerably among countries. In Asia, poultry production is shifting to large-scale "factory" systems. In Africa, it is becoming a middle-income farming system, with indigenous breeds being replaced by American lines (case 5.6). In Latin America, there is a closer balance than in Asia between large, modern producers, on the one hand, and the use of improved technology by small farmers, on the other.

Case 5.6 Backyard poultry farms in Morogoro

Professors living at Sokoine University of Agriculture, in Morogoro, Tanzania, for several years have been raising chickens in backyard coops; some farms have as many as 100 birds. Two-thirds of faculty families are in the field, raising chickens or producing fruits and vegetables in the backyard.

The chicks and the technology are imported from Zambia, and the quality of the operations and yields are good. The chicken farmers get free piped water and electricity from the government. The household plots, too, are rent-free. Extension help is available from staff at the university. (There has been a debate in Tanzania about the appropriateness of government-salaried staff using free resources and university expertise for personal profits.)

The efficiency of the poultry farms is high due to good in-house technology, research and extension capacity. A considerable capacity in poultry farming has been built up. The university staff could easily transfer the technology to low-income farmers and provide them extension support, making their efforts even more productive for the city.

Contact: Dr. Zebadato S.K. Mvena, Sokoine University, Morogoro, Tanzania.

An intermediate technology exists between chickens scratching in the backyard for scraps and offal and the chicken factories so common to the fringes of large cities in industrial countries. This intermediate technology is exemplified by the bookcase-style, stacked, small-live-stock cages at the Centre for Education and Technology in Santiago, Chile (see photo 5.7). In this farming system, shelves with cages for chickens and rabbits are attached to a wall or fence. Typically, one shelf may have layers; another, broilers; a third, chicks; and a fourth, rabbits. Their feed consists not only of household and vegetable garden scraps, but also worms and maggots that have fed on offal. Such systems incorporate recycling the waste of local businesses (restaurants and green grocers) and the wastes of other urban farming systems.

Ducks, geese, pigeons and other poultry each have an appropriate place in urban agriculture. In India, raising ducks is an important agricultural activity in urban areas. One government official said that "duck eggs are in great demand in urban markets and contribute

much to the food requirements of the vegetarian (unfertilized eggs) and non-vegetarian communities."⁹

Poultry production provides fertilizer to horticultural crops and food to aquatic crops. The farmer in Bangkok, for example, feeds the droppings of the birds to his fish and lays the sludge from the bottom of the pond as a manure on his vegetable plot. Pigeons are an efficient rooftop farming system. Ducks and geese fit particularly well with some pisciculture systems, as they eat grasses and weeds on land and in the water and their offal provides

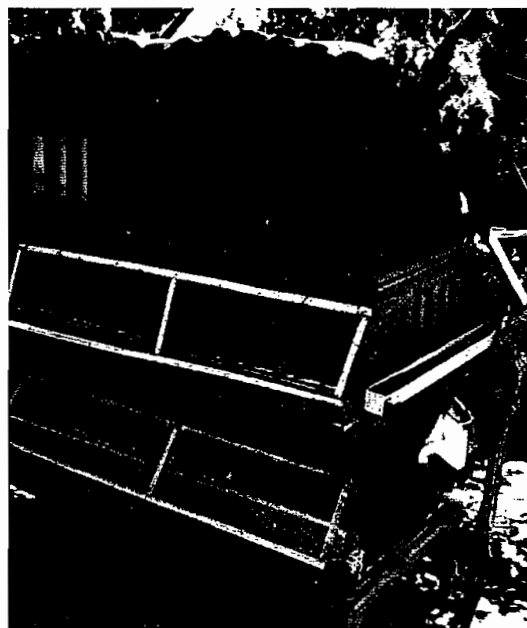


Photo 5.7 "Bookcase" chicken raising in Santiago

Small livestock

Microlivestock is now seen by many as an important technology for sustainable development. Small animals are generally more efficient converters of feed to meat than large animals. In many cities, micro-livestock (especially rabbits and guinea pigs in Latin America) is a common form of urban agriculture. In some of the world's largest cities (for example, Cairo), livestock rearing is more common than growing vegetables.

Rabbits in particular are ideal animals to raise in the city. They do not take up much space, are cheap to feed and are prolific breeders. Rabbits can be fed grass; leaves; greens thrown out by stores, markets and restaurants; food scraps from the kitchen; alfalfa or other forage crops from the garden or bought; or chicken or pig feed from feed stores. For some, the rabbits they raise may be their only source of meat. Rabbits and other microlivestock are also sources of skin and fur for sale in the local market. They also generate dung, which can be used as fertilizer for gardens.

Microlivestock is practised widely by low- and middle-income farmers. The biggest constraint are health laws. In addition, farmers often use inefficient growth practices, and improvements in extension services may be needed. Small producers would benefit from marketing cooperatives.

Large livestock

The significance and form of large livestock production in the city varies considerably from country to country. In Africa, where built-up areas in many cities still have low density, the practice of raising livestock for milk and meat is now widespread (case 5.7). However, a recent survey in Kenya found that low-income Nairobi cattle farmers lost more cattle to disease than they brought to market. In Latin America, where raising livestock has been a way of life in many places, it is being pushed out of the cities.

In Asia, grazing on public land and milk production in urban locations are still common. Urban land use regulations based on Hindu and Moslem traditions allow livestock raising in cities under performance-based standards, rather than the blanket disallowance prevalent in European and American urban planning regulations.¹⁰ It should be noted that in southern Europe, livestock grazing of public parks



Photo 5.8 Pigs raised on market waste in Ghana, Abidjan

and other open spaces continues wherever there is a continuity of Roman law.

Large as well as small urban livestock can be produced at high densities in “zero-grazing” (stable-fed) farming systems, where fodder is brought to the animal instead of the animal being taken to graze. Zero-grazing has many benefits as a symbiotic link in the cycle of urban agriculture. It also requires stringent quality control management, necessitating cooperation between public entities and private farmers and processors. Research is needed to bring the benefits of zero-grazing now enjoyed by large producers to small producers.

Case 5.7 Milk production in the Oyster Bay district of Dar es Salaam

Influential upper-income families in Oyster Bay—a rich residential area of Dar es Salaam, Tanzania—raise imported cross-bred cows in backyard stables for milk production. The cows are herded by hired cow herds and graze on roadside verges, stream banks, parks and private yards. Grazing helps maintain the roadsides and parks, but it may have resulted in overgrazing at the beachside park.

Oyster Bay is a former colonial residential neighbourhood with expanses of open space. The farming activity in Oyster Bay started with some residents perceiving a market need. Milk is in short supply and sells at a high price in Dar es Salaam. Thus good profits can be made with just a few cows kept at home.

According to a survey reported by Sokoine University, at least 90% of government officials residing in government houses in Oyster Bay raise several heads of cattle, cows and goats. (The Dar es Salaam City Council officially permits each household four animals.) That upper-income farmers are raising cattle shows the range of the industry.

The farming activity is controversial and criticized as non-hygienic and unsuitable for urban areas. Livestock rearing in the city had been illegal but gained acceptance under policy changes enacted in the 1980s. Actually, grazing of native cows on

public land at the city fringes has always been practised in Dar es Salaam. This case of livestock rearing in a wealthy neighbourhood, and other similar farming activity, may lead to increased acceptance and policy support for urban farming in Africa.

Contact: Dr. Zebedato S.K. Mvena, Sokoine University, Morogoro; and Dr. Camillo Sawio, University of Dar es Salaam, Dar es Salaam, Tanzania.

Serious problems can arise from urban rearing of large livestock. A Canadian analyst says some “urban agriculture activities are not as benign as others”.¹¹ Risks encountered in the practice of urban animal husbandry include health problems such as bovine tuberculosis and environmental problems such as overgrazing (see chapter 8). Finally, although production of large livestock has a role in the city, that role must be assessed carefully, especially in comparison with the role of smaller animals, birds and vegetal food products.

Agroforestry

In much of the developing world, wood is the primary fuel for cooking and space heating. As cities grow, access to fuel wood becomes more constrained as demand increases, costs soar and the areas around cities are desertified and eroded.¹² Furthermore, residential construction, particularly self-help construction, is often dominated by timber; wood for timber is also becoming scarcer and more expensive as urbanization increases. Managua, Nicaragua, was a particularly tragic example after a decade of war and economic sanctions. When imports of petroleum were cut off, the forests for tens of kilometres around the city disappeared. A similar situation has occurred more slowly around Addis Ababa, Ethiopia. The African Development Bank recently extended a large loan to assist the new government in reforesting the peri-urban areas.

Urban agroforestry can help mitigate these problems and contribute further benefits at the same time. Urban forests have the potential to be managed for social, economic, environmental and recreational benefits. Managed forests that produce fuel wood and construction materials can also produce food, through fruits and intercropping with vegetables and grasses. There is a huge untapped possibility of combining urban forests and urban waste management. Furthermore, large peri-urban forests, of which there still are many around the world, have a unique role in maintaining biologically diverse domains close to urbanized centres.

In most places, street trees serve primarily aesthetic and climate modification purposes. In a few places, they play a more significant role. Bangalore, India, uses a substantial share of its street trees for fruit production. In Hungary, the harvests of street-side plum trees are auctioned. In Argentina and Chile, oranges are grown on streets for hospitals, schools and orphanages.

Urban agroforestry involves more than street trees; it generates a large variety of economic enterprises. In Panama, agricultural shantytowns produce forest and vegetable crops just across the Panama Canal from downtown Panama City. In Greece, olives are grown in cemeteries. In peri-urban Nairobi, urban agroforestry produces coffee, vegetables and fruit. Leaves are collected throughout the Sahel for food as well as for medicine. Indian peri-urban areas have numerous nurseries for small palm trees that are grown for nutritional as well as decorative purposes. In China, 17% of the trees in Beijing (and as much as 42% in some others areas) are estimated to be fruit trees.¹³

A managed food and fuel production program in Lae, Papua New Guinea, helps meet the needs of the city while rehabilitating the surrounding hilly area (case 5.8). In many parts of the world, urban trees offer the poorest urban residents a means of generating either actual or fungible income—by collecting nuts; recovering fallen trees for recycling as fuel wood, construction material or wood for handicrafts; and gathering fodder, herbs or shrubbery.

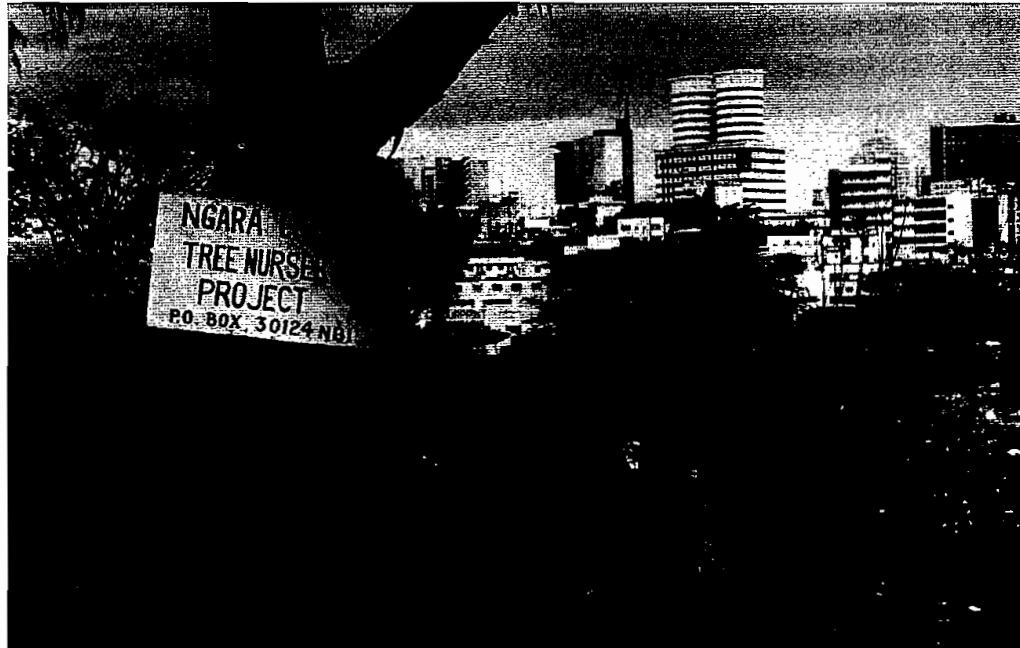


Photo 5.9 Ornamental tree nursery in the heart of Nairobi

The environmental contributions of urban forests and other treed surfaces are vast. The capacity of shrubs and trees to maintain steep slopes and wetlands has been underrated by most urban administrations. The capacity of woodland for absorbing wastewater for irrigation is just beginning to be tapped, for example, in Lima and Cairo.¹⁴ Kuwait and Aden also recycle their wastewater into urban forests, flowers and food. In addition to the treatment of soiled water, important aquifers lie under many metropolitan forests. The maintenance of these forests thus plays a role in the provision of drinking water to the city.

Urban forests act as natural filters and are central to combating urban air pollution, especially carbon dioxide and particulate matter. They effect considerable modifications in the microclimate, consequently conserving energy by reducing the need for heating and cooling buildings. A pioneering study sponsored by the US Environmental Protection Agency and the Chicago Urban Forest Climate Project is currently under way to quantify the impact of forest vegetation on local climate, energy use and air quality.

Case 5.8 Food and fuel production programme in Lae

The city of Lae, Papua New Guinea, began a comprehensive food and fuel production programme in 1977 in response to increasing malnutrition, dependence on imported food, deforestation and pollution from solid waste buildup in the city. A rehabilitation programme was started for the peri-urban Aztera Hills region, which had suffered severe deforestation and degradation as a result of city residents stripping fuel wood or farming it for short-term use. The programme created zones for ecological rehabilitation and conservation, fuel wood cropping and agroforestry.

A managed forest and farming area was created to fulfill the food and fuel needs of the city while ensuring sustainable development of the hilly area. Trees useful for erosion control were planted to rehabilitate hillsides and stream banks.

The agroforestry programme leases (or gives out permits for) plots averaging one-tenth of a hectare to farmers for symbiotic planting of trees and vegetables. The tenure security has encouraged farming practices that are ecologically sustainable and long term, while providing fresh food for the city.

The city also planted fruit and nut trees in public areas and provided free seedlings to city residents for planting at their homes. Funding of research on appropriate species was also provided.

A number of other programmes were set up. The city started community gardens (1,500 gardens, each 10 by 20 metres in size, in the first three years) in low-income areas, and plots were allotted to poor families. The farmers were given assistance in planting techniques, crop selection, nutrition and so on by government horticulturists. Locally made compost was used.

A school nutrition programme provides high-nutrition food in schools from crops grown in city and school gardens. The food is produced by a private company and sold at a low cost, subsidized by the city.



Photo 5.10 Urban agroforestry with multicropping in Lae

The high rainfall and soil erosion create a need for soil improvement. The city is composting organic waste at landfill sites. In the first two years, 1,500 tons of compost were produced and used to fertilize all the farmed space in the city. The city planned to increase its production to 11,000 tons a year.

Technical assistance was provided by the UNICEF and UNEP's Man and the Biosphere Programme, the Australian National University and others. After early success, this programme had a downturn, which is reported to be largely the result of land tenure issues rather than farming system issues.

Contact: See source listed in appendix C.

For some cities, like Dakar, Senegal; Beijing, China; and Ismailia, Egypt, tree cover also provides crucial protection against the encroachment of sand and dust from nearby arid or desert areas. Woodlands also maintain the soil, protecting against erosion, particularly on steep slopes. At Mont Ngafulla in Kinshasa, low-income farmers, with help from a horticulturist and the forestry department, created tree orchards and nurseries to control soil erosion through a productive use. In the floodplains of the Nairobi River, slum dwellers planted fruit trees and other crops to save themselves from river floods.

While some cities have seen the green coverage increase, others have experienced serious loss. In Mexico City, the percentage of green areas in the metropolitan area fell from the already low 2.8% in 1910 to just 2.2% today.¹⁵ Meanwhile, the green space cover in Beijing increased from 3% in 1949 to 28% four decades later, higher than the national average of about 20% for Chinese cities.¹⁶

The importance of trees in general does not mean that all trees are comparably valuable. The choice of trees to plant is an important decision for the urban forester. For example, a species that requires little water is obviously more appropriate in drier climates.

Urban forestry has some special constraints and problems, in addition to those common to all forms of urban agriculture, as described in chapter 9. In particular, the length of time required to grow a tree is longer than for any other crop. Consequently, security of tenure or licence is especially important for the longer-term investment in tree planting. In dense urban areas, the roots of larger trees or their falling branches can cause structural damage to buildings. Damage can be minimized through species choice and maintenance.¹⁷

Further, the harsh conditions in the urban ecosystem mean that the urban tree is more vulnerable to a variety of environmental stresses, including disease, pollution, poor soils and vandalism.¹⁸ The survival rate for trees planted can be low; in Mexico City, for example, fewer than half the trees planted survive to maturity.¹⁹ Research to continue to develop or identify trees that can adapt to the urban environment, as well as diffusion of what is known about the benefits of urban forestry, are crucial to surmount these special hindrances.

Agroforestry has substantial potential in the short term to contribute fuel, construction materials and food. In the long term, urban agroforestry may additionally be important for reducing the indirect impacts of cities on surrounding and more distant ecosystems, and for biologically processing urban wastes into clean air and water. All these functions complement the special contributions that woodlands provide to the physical and mental well-being of urban residents, as trees are aesthetically pleasing, soothing and noise-reducing.

Other urban farming activity

Urban agriculture fills additional market niches beyond food and fuel. Some of these might be labelled “exotica,” but they are economically significant. Snails are raised indoors and in yards. Ornamental fish for living room tanks are an important crop in some cultures. Straw and small branches are a common crop output for basket weaving.

Three forms of cultivation should be noted in particular: api-

culture, vermiculture and mycoculture. In addition, some specialized forms of horticulture not discussed earlier deserve mention: beverage crops, medicinal crops and—most notably—ornamental horticulture.

Fauna

Apiculture involves specialized techniques of beekeeping and can often be found in peri-urban areas. A labour-intensive activity, apiculture can be a significant employment generator or a side activity for small farms. Wax obtained as a by-product has much commercial utility, particularly as a source of lighting material.²⁰ Finally, the role of bees in pollination to promote biodiversity within communities and cities is clearly vital.

Vermiculture (the raising of worms) has diverse uses in the urban context. Silk is spun by worms in boxes on verandas; the worms eat mulberry leaves, which are delivered daily. Worm larvae are also raised as fodder, especially for chickens. Applying worms to the composting process (vermi-composting) greatly increases its effectiveness.

Flora

Many cultures around the world include mushrooms in their diet. As the world has become more urbanized, mushrooms, which once were collected in fields and forests, are mostly grown in cellars and sheds, making *mycoculture* a primarily urban form of production. The technology is being transferred from Asia and Europe to Latin America and Africa, usually first to corporate and well-to-do farmers.

Transnational agribusiness is producing mushrooms in several developing countries, frequently in urban areas. At the same time, small growers are producing for the local market. Like hydroponics, mushroom farming requires less access to land and water than horticulture and livestock rearing. In an exciting project supported by the Food and Agriculture Organization, Thai mushroom experts taught Ghanaians how to grow mushrooms in sheds behind their houses; traditionally, the mushrooms common to Ghanaian cuisine had been collected in the forest and at the edge of roads.²¹

Beverage crops include grapes, hibiscus, palm, tea, coffee, sugar cane, qat (a tea substitute) and matte (an herbal tea). A number of these



Photo 5.11 Vineyards overlooking central areas of Freiburg, Germany

are grown intensively in urban areas. Grapevines, for instance, are planted on slopes that are too steep to build on in the very heart of European cities such as Freiburg and Würzburg (see photo 5.11). Postproduction processes—in particular, processing (turning the crop into a beverage)—are crucial for the farming of these plants, and they yield important downstream entrepreneurial activities. Street and door-to-door sales of “homemade” beverages are common in cities of the developing world.

One study of the rural-urban interface in Tanzania found that two out of five farmers in and around the small town of Biharamulo included alcoholic beverage crops in their product mix.²² The income generated by these crops ranged from 46% to 78% of farmers’ total income. The most common type of beverage was beer made from bananas; the second was distilled spirits. Production was strictly divided by gender: all beer was made and sold by women, while all spirits were produced by men. Most significantly, the households that combined alcohol production and sale with other agricultural crops were more secure and had a constant cash flow to meet the household budget.

Medicinal crops are another important urban agricultural crop. In many countries, the use of medicinal herbs by urban residents remains widespread, and medicinal crops are traditional in many urban small farms. Along with culinary herbs, which require similar management, they provide an important cash supplement for small urban farmers.



Photo 5.12 Large-scale ornamental horticulture in Port-au-Prince

This underlines the importance of bringing nutritionists and health care specialists into urban agriculture studies to define opportunities and risks.

Finally, *ornamental horticulture* is predominantly an urban farming system, since the market exists almost entirely in cities (photo 5.12). In most cities, we found large numbers of ornamental plant farmers and floriculturists. Generally, this has been a peri-urban phenomenon, but it has been moving towards downtown, on roadside verges and in plastic containers.

Ornamental horticulture has the twin distinctions that it is aesthetically pleasing and its product is in demand by the elite. It is therefore found in parts of cities where vegetable or livestock farmers may not be welcome. The crops can be grown at a site temporarily, for as little as one season. It is most commonly a middle-income farming system. Large growers and corporations tend to move into the flower market more than into the production of trees, house plants and shrubbery.

Access to water and credit are particularly important issues for ornamental horticulture. Production in greenhouses can have negative environmental impacts due to intense monocropping with heavy applications of fertilizers and insecticides. When not grown in greenhouses, the product itself can be friendly to the environment, contributing to cleaning the air.



Each of the urban farming systems discussed in this chapter has the potential to contribute to sustainable development and sustainable cities. Bringing agriculture—with its capacity to transform waste into crops—into cities can move them towards sustainability. It can also reduce pressure on the land in rural areas, which frequently are engaged in unsustainable farming systems. Both urban and rural areas have a great need for sustainable agriculture, but its benefits are multiplied in urban settings.

Notes

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3. National Academy of Sciences, *Making Aquatic Weeds Useful: Some Perspectives for Developing Countries* (Washington, D.C.: National Academy of Sciences, 1976), pp. 127–44.
4. R. L. Meier, University of California at Berkeley, personal communication, August 1991.
5. West Bengal Department of Fisheries, *Annual Report* (Calcutta: West Bengal Department of Fisheries, 1990).
6. International Institute of Rural Redevelopment/UNICEF, *The Family Food Production Program in Negros Occidental 1986–1990*, final project report, 1991.
7. Food and Agriculture Organization, “Technical Report (Farm Management/Farming Systems): Development of Pekarangan Land,” project TCP/INS/8852, 1990.
8. Friedhelm Streiffeler, “General Principles and Approaches for Sustainable Urban Greenbelts with Special Reference to Africa,” Technical University of Berlin, Department of Rural Sociology, 1993, p. 14.
9. G.K. Choudhury, chief planner, Calcutta Metropolitan Development Authority, personal communication, 1992.
10. See, for example, the master plan of Amman, Jordan, 1990.
11. Christine Furedy, personal communication, 1993.
12. One estimate for Dakar, for example, is that urban charcoal consumption exceeds 1.5 million cubic metres, which would correspond to 3,000–5,000 hectares of savannah and steppe. Thus fuel wood production is “an obvious function that cannot be ignored”. See E.H. Sène, “Urban and Peri-Urban Forests in Sub-Saharan Africa: The Sahel”, *Unasylva* 173, no. 2 (1993): 48.
13. George Profous, *Report: The Structure and Management of the Urban Forest in Beijing, the People's Republic of China* (New York: Northeast Forest Experiment Station, USDA Forest Service, 1990), quoted in Stephen Dembner, “Urban Forestry in Beijing”, *Unasylva* 173, no. 2 (1993): 16.
14. E. Jane Carter, “The Potential of Urban Forestry in Developing Countries: A Concept Paper”, draft (Rome: Food and Agriculture Organization, June 1993), p. 34.
15. M. Caballero Deloya, “Urban Forestry in Mexico City”, *Unasylva* 173, no. 2 (1993): 30.
16. Dembner, “Urban Forestry in Beijing”, pp. 14, 18. Note that municipal boundaries in China were stretched in the 1960s, incorporating vast agricultural areas.
17. Carter, “The Potential of Urban Forestry”, p. 42.
18. Guido Kuchelmeister and Susan Braatz, “Urban Forestry Revisited”, *Unasylva* 173, no. 2 (1993): 11.
19. Deloya, “Urban Forestry”, p. 31.
20. Choudhury, personal communication, 1992.

21. Patrick Addey, "Growing the Food of the Gods: Ghana's Success in Mushroom Cultivation, *Choices* (Summer 1993).
22. Jonathan Baker, "Survival and Accumulation Strategies at the Rural-Urban Interface in North-West Tanzania", *Urban Perspectives* 4 (May 1994): 12–17.

Which organizations influence urban agriculture?

As discussed in chapter 1, urban agriculture is intricately tied to a number of urban systems, including health and nutrition, the economy, land use, ecology, infrastructure, waste management and transport. Thus it requires more interaction with, and is more sensitive to, the influence of civic, governmental and private agencies than most other industries—a fact that may have played a role in hindering its full development.

The organizational constraints the industry faces and the policies needed to overcome them are discussed in chapters 9 and 10, respectively. This chapter discusses the kinds of policies and actions now being pursued by various organizations. It is descriptive, not prescriptive.

Different roles for different organizations

A great number of organizations influence urban farming. They can be categorized into five groups: farmers associations, non-governmental organizations (NGOs) and other support entities; local and national governments and other public authorities; institutions, including independent and university research centres; international development agencies; and miscellaneous other stakeholders.

These actors can be classified according to the four roles they fulfill: regulating, facilitating, providing and partnering (table 6.1). One organization can fulfill multiple roles simultaneously or through different components. Moreover, actors not only influence urban agricultural activities, but are also affected by them, either unfavourably (as when poor agricultural practices cause health problems that require government intervention) or favourably (as when farmers use a wastewater treatment plant's sludge).

Table 6.1 Roles of organizations that influence urban agriculture

Organization type	Role			
	Regulate	Facilitate	Provide	Partner
Farmers association	—	▲▲	▲	—
NGO	—	▲▲	▲	▲
Local government	▲▲	▲	▲	▲
National government	▲▲	▲	▲▲	▲
Institution	—	—	▲▲	▲▲
Research institute	—	▲▲	—	▲
International agency	—	▲▲	▲	—
Other stakeholder	—	▲▲	▲▲	▲

▲▲ = primary role; ▲ = substantial role; — = insubstantial role.

Source: Compiled by The Urban Agriculture Network from various sources.

Urban agriculture is *regulated* through a variety of laws, rules, regulations and programmes. Regulating actions range from general policies that grant or deny a stamp of approval to eviction, cutting down plants or confiscating livestock. Legislation impacting urban agriculture includes land use, building, environment and health codes. The enforcement of regulations is most often the responsibility of local governments. National governments have important roles in establishing and enforcing health and environment laws and regulations and in setting policy.

In addition to government laws and regulations, other less obvious regulating instruments include international codes, on which many national and local codes are based; crop quality or purity standards established by farmers associations for their members; and informal community controls on farming practices, often based on tribal, cultural or religious views.

Facilitation as used here includes providing technical advice and training; brokering relationships with markets, government, bankers and other groups; leading or supporting policy or regulatory change; eliminating constraints; providing information; and assisting in organizing. All actors described in this chapter can play facilitating (as well as constricting) roles.

Actors intensify their involvement in urban agriculture when they move from facilitating (which is equivalent to providing services) to *providing resources and inputs*. This assistance includes supplying seeds and tools, granting access to land and water or providing a processing facility or insurance. It can also include providing financial resources,



Photo 6.1 Sign posted at a large community garden for families of Costa Rican public forces, listing cooperating public agencies and NGOs

such as credit for purchasing inputs or land, funding for research or seed money to initiate an endeavor.

In most countries, governments and institutions are large holders of certain urban resources, especially land. They thus have a bigger stake in urban agriculture than most other actors, giving them a special place in the provision of these resources. When they act as a landlord or an active participant in, for instance, sewage-based pisciculture, their role moves from that of an important outside actor (regulator, facilitator, provider) to that of a directly involved party. This more intimate involvement is what is referred to as *partnering*. It occurs when there is a strong collaborative relationship: a university allows farmers to cultivate part of its vast land holdings in return for a share of the crop, a highway authority allows farmers to graze the verges in return for maintenance or a river port authority deposits dredge material on farmers' fields in agreement with a farmers association (see photo 6.1). Partnering can be the most fruitful of the four types of relationships for all parties involved. A number of potential partnerships are identified in chapter 10.

Support organizations

A variety of organizations support the activities of urban farmers (table 6.2). It is useful to differentiate three types. *Farmers cooperatives*, the

Table 6.2 Examples of NGOs active in urban agriculture

Organization	Country	Involvement
Urban Food Foundation	Philippines	Instrumental in forming a co-op of 500 small-livestock producers.
SODEM	Chile	Uses model gardens to train home gardeners; provides extension help.
Centre for Education and Technology	Chile	Provides training and extension to low-income farmers for biointensive gardening.
Undugu Society	Kenya	Supports urban farming for food security, enterprise and disaster management.
Peru Mujer	Peru	Provides training and organizes community gardens for low-income women.
Grupo de Estudios Ambientales	Mexico	Offers technical advice to <i>chinampas</i> farmers.
Kinshasa Farmers Cooperative	Zaire	Facilitates access to inputs, land and markets.
Indonesia National Agronomists Association	Indonesia	Provides information and lobbies the government.

Source: Compiled by The Urban Agriculture Network from various sources.

first type, were discussed in chapter 3; agricultural producers organize themselves into collective units to take advantage of certain economies of scale in production, marketing and so on. Whereas cooperatives are production entities, similar to an agribusiness but run by their members, *farmers associations* bring together independent farmers or farming cooperatives sharing certain interests or farming systems to assist them in gaining access to possibilities (and overcoming barriers) through lobbying, obtaining information, reforming laws and regulations and so on. Finally, *non-governmental organizations* (NGOs) generally do not consist of the farmers themselves, but are independent organizations that want—in addition to other commitments—to help the farmers.

The line between these three types of organizations can be fuzzy. Their structure and purpose can evolve over time: a cooperative may grow into a citywide farmers association; a farmers association in turn can become independent and acquire a variety of other roles, such as education and health improvement, thereby becoming an NGO. Since cooperatives have been discussed at length, farmers associations and NGOs are discussed in detail here.

Farmers associations

Farmers associations reach in one of two possible directions, sometimes both. They may seek to integrate the urban agriculture industry vertically by improving access to inputs, resources and services or to processing, distribution and marketing information and facilities. In other cases, farmers associations are organized horizontally within a farming system, cutting across urban and rural lines. An example is the association of fishermen cooperatives in the West Bengal area of India. Fishermen in the sewage lagoons in Calcutta perceive themselves as a part of the larger community of fishermen in the state; the association is organized at the state level, with regional and local subdivisions in both urban and rural areas. The fishermen thus express their needs, first through small cooperatives and then through the statewide association (see case 3.5).

In Jakarta, the urban members of the National Agronomists Society organized a two-day conference in 1992, with a focus on influencing national government policy. In Zambia, the National Farmers Association is reaching out to medium- and small-scale urban farmers. In Taiwan (province of China), urban farmers constitute the majority of farmers associations members. The very vocal and powerful association of 80,000 community gardeners in Berlin confronted the city's minister of construction in his 1994 attempt to make some of the land where gardens were located (often prime locations) available as construction sites.¹

Yet urban farmers associations are more the exception than the rule in the countries examined here. Many operate with only limited contact with their peers. Unlike rural farmers, urban farmers do not tend to see themselves as members of a common group or industry.²

Non-governmental organizations

Local NGOs are usually the primary facilitators of urban agriculture. NGOs often perceive themselves as pioneers and are playing crucial roles in developing innovations in the field. Along with community-based organizations, NGOs have the closest relationship with, and are most supportive of, urban farmers, especially the poorest and most disenfranchised.

NGOs can serve as links between farmers and the market, credit agencies, research institutions and the government. They assist through

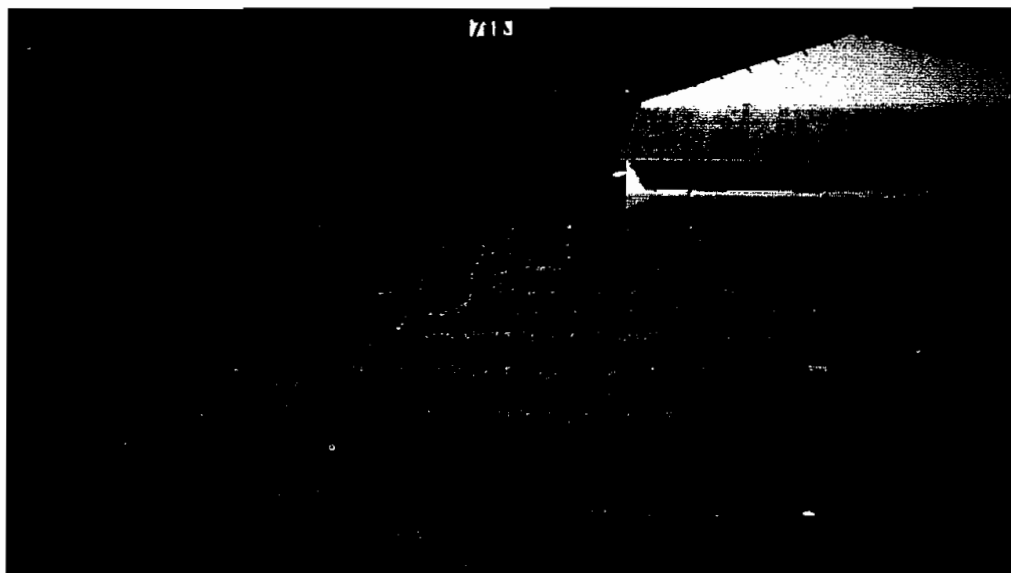


Photo 6.2 Training and research centre of SEMTA, an NGO in La Paz. The centre includes cold frames, a lean-to greenhouse, a windmill and classrooms.

a number of means: empowerment and general organization; technical assistance, extension and training; access to land, credit, insurance and inputs; and organizing markets and market information. Like farmers associations, NGOs can remove constraints that hamper small farmers and push for policy change in governments and other institutions.

NGOs are becoming increasingly active in urban agriculture. Not surprisingly, the countries with the highest level of NGO development among those examined—Chile and the Philippines—appear to have the highest level of NGO interest in feeding the cities through grass-roots efforts by the urban poor. In both countries, NGOs support production and processing with research and marketing programmes.

In Latin America, after having been a key part of the so-called alternative movement in the 1970s and 1980s, some NGOs that support urban farmers are now working in collaboration with the new democratic governments. Most typically, they are involved in promoting community development and self-reliant technology. KAIROS, a small NGO working with the poorest of the poor, particularly recent arrivals in metropolitan Santiago, supports horticulture at a solid waste dump, among other efforts. In Africa, NGOs are active in urban agriculture in Zambia, Tanzania, Côte d'Ivoire, Senegal and Kenya (case 6.1).

Reports identify similar activity in South Africa, Zaire, Mozambique, Zimbabwe and Ethiopia. Human Settlements of Zambia has worked for 20 years with international agencies—including UNICEF, the World Bank and the American Friends Service Committee—managing urban agriculture projects in settings from kitchen gardens to larger rain-fed plots at the periphery of the city (see case 9.1).

Case 6.1 Promotion of urban farming by the Undugu Society in Nairobi

The Undugu Society is a non-governmental organization in Kenya working to empower poor people engaged in handicrafts. The society noted that food is the main expenditure item for the urban poor and decided to promote farming as a strategy for nutritional self-reliance and well-being.

As a part of this project, access to land was negotiated and plots were allotted to farmers. Farmers grow several crops, including onions from waste bulbs collected in the market. Farmers are also assisted in keeping livestock—goats, ducks, rabbits and chickens—at their homes. Fruit trees, including mango, paw paw and avocado, are grown as companion crops to vegetables. Agriculture is integrated with handicraft activities and with environmental improvement projects.

Undugu is promoting the use of organic pesticides from local material in place of imported chemicals. Composting of household waste (including waste paper and plastic and organic waste) is adopted for soil renewal and as a solution to the problem of waste disposal. The Nairobi City Council denied the farmers' request to collect garbage from nearby high-income residential areas by truck, although it is permitted by handcart.

In the slum of Kitui-Pumwani, Undugu has helped to establish a banana plantation to protect the slum from flash floods in floodplains.

Contact: Paterson Kuria-Gathuru, Undugu Society, Nairobi, Kenya.

NGO involvement in urban agriculture is relatively limited in Asia except in the Philippines, where the Urban Food Foundation is providing active support to urban farmers (see case 9.5). Another NGO in the Philippines, the International Institute for Rural Reconstruction, is assisting intensive home and community horticulture and small-livestock farmers.

Urban agriculture often fits into local organizations' basic agenda of service to the poor, which includes alleviating poverty and overcoming hunger and malnutrition. For many NGOs, urban agriculture starts as a secondary activity: when they recognize the benefits farming offers to the low-income residents whom they assist, they gradually add urban agriculture to their areas of support. In Peru, community kitchens integrated backwards to food production, in one case in cooperation with the national government and an international NGO. Self-help housing groups sometimes include urban agriculture as an informal industry.

In addition to their principal role as facilitators, NGOs sometimes are resource and input providers. For example, they may provide seeds, ease access to land or contribute a water tank, perhaps as a “funnel” for an international development agency or a charitable organization. Less frequently, NGOs actually go into partnership with the farming community by establishing and running a hawkers market or a hospital garden for producers within a community.

Governments and public authorities

The roles of governments and public agencies are the most complex and comprehensive of all the actors in urban agriculture. They play all of the roles discussed above in relation to urban agriculture. They are policy-setters, regulators and facilitators. In addition, they are major landowners and the managers of wastewater, solid waste and water supply systems; this role gives them the highest potential for partnership with urban farmers.

Most governments still perceive urban food and fuel production as a marginal and temporary activity. In general, the trend towards increased urban agriculture is being followed, not led, by organizational changes in government. Lack of communication with NGOs, farmers groups, researchers and institutions within the urban region can result in missed opportunities. On the other hand, governmental leadership in facilitating urban agriculture can attract other support and contribute to food security and other benefits (table 6.3).

Local governments

The most frequent reaction by local governments to urban agriculture is to limit it. Most municipal regulators are concerned first and foremost with health and aesthetics and view agriculture as a rural activity that is inappropriate in the modern city. Local government limitations range from disallowing any form of urban agriculture to setting specific limits, such as four cows per household in Dar es Salaam.³

Yet some municipal and metropolitan governments are beginning to recognize urban agriculture's role and to establish agricultural departments. Mexico City, Buenos Aires and Jakarta have such departments, including research and extension divisions. In many cities, the parks

Table 6.3 Examples of governmental organizations active in urban agriculture

Organization	Location	Involvement
Water authority	Mexico City	Provides irrigation and oversight of peri-urban farming.
	Jakarta	Formed joint venture with fisherman to harvest reservoirs.
Port authority	Calcutta	Leases land and lagoons to co-ops.
Highway authority	Indonesia	Leases right-of-way land to urban farmers.
Electricity authorities	Canada	Produce vegetables in greenhouses.
Municipality	Munich	Produces fish in sewage lagoons.
	Maputo	Act as land-owning partner with women's food production co-op.
	Jakarta, Mexico City, Buenos Aires	Created urban agriculture agency.
	United States	Leases land on bases to farmers.
National government	Argentina, Peru	Has national agency for urban agriculture.
	Panama, Tanzania, Zambia	Recently adopted policies that favour urban agriculture.
	Italy, China, Japan, Singapore, Netherlands	Has long-standing urban agriculture policy and agencies.
	Malawi, Tanzania	Plans for a new capital to include urban agriculture.

Source: Compiled by The Urban Agriculture Network from various sources.

departments are accountable for agriculture and often also grow their own trees and shrubs.

In Dodoma, the new capital of Tanzania, the Capital Development Authority supports agriculture within neighbourhoods, in green belts around neighbourhoods and in peri-urban zones.⁴ The municipal government in Lilongwe, the new capital of Malawi, also officially recognizes urban agriculture as an activity.

The facilitator and provider roles of local government are thus very broad, particularly in relation to various issues of access. A few cities have also become partners in some urban farming practices, such as school gardens, primary agricultural education, street fruit trees and fish farming in municipal waters. In Maputo, Mozambique, the municipal government is a land-owning partner in the “green belt” (*zonas verdes*) farming cooperatives that are a major source of food and employment for the residents.⁵ In Shanghai and other Chinese cities, the government actively promotes urban farming (see case 6.2 and photo 6.3).

In municipalities, one key individual who becomes interested in urban agriculture often can act as a catalyst in gaining acceptance

and more active support for the industry. For instance, in Bulawayo, the second-largest city in Zimbabwe, the town clerk has become a dynamic force in initiating a municipal programme to support urban agriculture. The city's Department of Housing and Community Services now makes available both garden allotments (irrigated with reclaimed water) and rain-fed maize field allotments (larger but farther away). In parallel to these allocations, the city also grants permits for commercial cultivation in residentially zoned areas (which cover most of the city). The city thus plays the roles of regulator and facilitator/provider.⁶

Case 6.2 Government-planned urban farming in the Shanghai urban region

In the 1960s, when the boundaries of Chinese municipalities were expanded, one criterion defining each municipality was nutritional self-sufficiency. In most larger cities, vegetable corporations were created, which in turn established relationships with the authorities responsible for land, solid waste, sewerage, industrial waste and farmers cooperatives. Production and processing were integrated within a single system. Each city established or renovated public and private markets, and individuals and cooperatives could choose their market.

During a period of very rapid urbanization from the 1960s onward, Chinese urban planners and managers supported urban agriculture. The urban regions (which are much larger than those in most other countries) have become self-reliant in perishable foods; at least half the major cities have some exports to surrounding areas. Fresh vegetables, fruit and meat are available in all small and large cities. Vegetables picked in the morning are available at retail for dinner, and chicken, pork and fish are also available fresh daily (see case 4.6).



Photo 6.3 Master plan for Canton, which includes agriculture

A number of factors contribute to the successful promotion of nutritional self-sufficiency in China. First, the authorities were philosophically committed to self-sufficiency and to seeking less reliance by urban populations on rural ones. Second, the cooking customs created a demand for fresh ingredients—even though there was no dependable transport system to provide them from a distance. Probably most important was the centuries-old tradition and technology of urban agriculture, based on recycling urban wastes into food.

A standout among the country's many cities is Shanghai. Since the 1950s, the Shanghai municipal government has planned and managed food production in the municipal region to effectively

satisfy the food demands of a population that now exceeds 14 million people. The government's objectives have been to create local food self-reliance within the urban region and to reduce transportation, storage and fuel consumption.

The municipal government divided the urban region according to the type of agriculture for which it is most suited—farming, forestry, fisheries or animal husbandry. An integrated urban food policy and a technology research, assistance and extension programme are geared to local needs. The economic and managerial aspects of farming are integrated, and the city supervises the collection and usage (for farming) of solid and liquid waste, including night soil (see case 9.5).

Until recently, the system supplied all of Shanghai's fresh vegetable demand. It also supplies a significant percentage of the grain, pork, poultry, fish and other food demands. Fresh vegetables can be bought in the market within ten to 15 hours of harvesting. The government supply system has successfully combated food shortages since 1949. However, loss of agricultural land combined with booming populations have gradually led Shanghai and other Chinese cities away from self-sufficiency, with an increasing reliance on imported agricultural products.

Contact: See source listed in appendix C.

National governments

National governments influence urban agriculture in setting policy, defining regulations, facilitating processes, providing resources and sometimes by being a partner. In Peru and Argentina, national government organizations provide seeds and seedlings, training and information to hundreds of institutions and NGOs.

Typically, national governments originate and then monitor regulations that are applied by local governments. National governments direct agricultural research and provide extension agents, and urban agriculture functions within national food, urban and agricultural policy. Some countries (including China, Japan, the Netherlands and Italy) have had policies and agencies supporting urban agriculture for decades, sometimes using tax codes to provide incentives to urban farming.

A great deal of urban agriculture takes place on national government land such as highways, railways, ports and parks. Myriad branches of national and regional government thus have a bearing on farming activity in urban areas, including branches whose mandate is neither agriculture nor food supply. The Mexico City regional water authority, for example, provides irrigation from sewage as well as oversight for nearly 100,000 hectares of farm area that feed the city.⁷ Indonesia's toll highway authority leases land within the rights-of-way to urban farmers. In the United States, some military bases lease surplus land to farmers.

Institutions

The roles of institutions in relation to urban agriculture are well focused in two main areas: providing resources (particularly surplus land) and conducting research. All kinds of institutions can do the first, while the second is the realm of universities and independent research centres, both those based locally and those based outside the country. In the case of resource provision as well as research, the relationship between the institution and the producers may take the form of a partnership. The institutions' motivation may sometimes be profit.

Institutional providers

Institutional support for urban agriculture from universities, utility authorities, hospitals, churches and charities has a long history. In Haiti and Peru, hospitals lease land to NGOs for food production. In the Philippines, it is the national university. In Canada, some electric utilities produce vegetables in greenhouses heated by the water used to cool the generators. In Brazil, utilities partner with farmers to maintain the land under power lines (see case 4.9).

In India, the Port Authority of Calcutta is a partner with fishermen cooperatives in the sewage lagoons, while the Bombay Port Authority enables its workers to raise vegetables for the market by providing land and technical assistance. Church-based community gardens are common in many countries; some churches provide essential inputs.

Research institutes

Although there appear to be no formal programmes labelled "urban agriculture" at universities or research institutions, a great deal of expertise and information is being accumulated by individual researchers. A number of doctoral and master's degree candidates in the United States, Canada, the United Kingdom, Germany and the Netherlands are focusing on urban agriculture. Most of these students come from developing countries and survey their native country as part of their research.

No uniform, comparative, formal global survey of urban agriculture has been undertaken to date; however, a number of universities

and research organizations have conducted city and national surveys, especially in Africa. A two-year survey by Sokoine University in Tanzania in the early 1990s is providing a foundation for projects supported by the German and Dutch governments.⁸ Similar surveys, although generally less comprehensive in national scope, have been conducted in Kenya, Uganda, Togo, Zambia, Argentina, China, Indonesia, Nepal, Papua New Guinea and Poland.

Although not explicitly under the heading “urban research”, a large body of research has been conducted on techniques that are particularly relevant to farming in urban conditions, generally at institutions in developing countries (case 6.3). These techniques include poultry, biointensive gardening, hydroponics, aquaculture, various greenhouse-based technologies and most waste-processing farming methods.

Case 6.3 AVRDC’s multipronged programme

The Asian Vegetable Research and Development Center (AVRDC), in Taiwan (province of China), is dedicated to improving production techniques and the quality of vegetables in Asian, African and Latin American countries. The centre conducts technological research, carries out field research and provides training and extension to farmers and promoters of farming. The AVRDC also works to increase the research, training and extension capacities of similar research organizations and is a part of the informal network of international agricultural research centres.

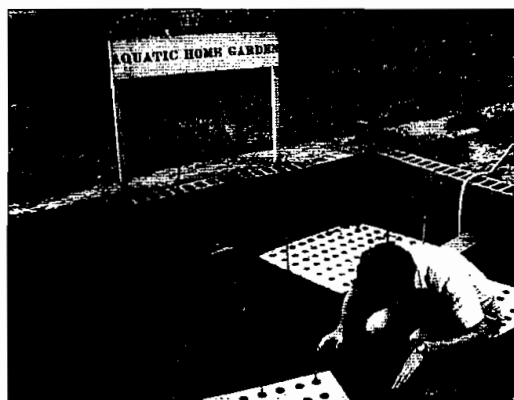


Photo 6.4 Researcher at an AVRDC experimental facility in Taiwan studying small-scale aquatic home gardens

Although urban horticulture is not the AVRDC’s primary concern, through its work in horticulture the AVRDC is involved in research directly or indirectly relevant to urban farming. The centre holds workshops on intensive and nutritious vegetable production in household gardens to provide increased vitamin A and essential minerals, produces improved varieties of vegetables and disseminates them to farmers through linked research and extension agencies and works on improved crop and soil management practices.

As part of the group’s Vitamin A Gardening Project in Africa, training in vegetable gardening and nutrition is provided to African agricultural institutions. The AVRDC has worked on several urban or peri-urban horticulture projects, including one in Tanzania. In 1993, it began expanding its activities to Central America. *Contact:* David J. Midmore, AVRDC, Taiwan (province of China) (see appendix F for complete address).

Table 6.4 Examples of universities and other institutions involved in research on urban agriculture

Organization	Location	Description of research
Sokoine University	Morogoro, Tanzania	Two-year survey of six cities.
Asian Institute of Technology	Bangkok, Thailand	Pilot projects in intensive agricultural techniques.
University of the Philippines	Los Baños, Philippines	Research on small-scale farming.
Centre pour le Développement de l'Horticulture	Dakar, Senegal	Research and extension on urban horticulture.
Asian Vegetable Research and Development Center	Kaohsiung, Taiwan	Research and extension on urban horticulture and household gardens in East Asia and Africa.
CEPIS	Lima, Peru	Wastewater aquaculture and horticulture.
Centro el Canelo de Nos	Santiago, Chile	Nine research projects in urban farming technologies.
Mazingira Institute	Nairobi, Kenya	Survey of urban agriculture in six cities.
University of Cairo	Giza, Egypt	Plastic tunnel horticulture.
Centro Las Gaviotas	Bogotá, Colombia	Hydroponics for low-income, high-density communities.
Makerere University	Kampala, Uganda	Research and surveys on urban agriculture.
Botanical Garden	Jakarta, Indonesia	Research on composting with small-scale urban farmers.

Source: Compiled by The Urban Agriculture Network from various sources.

Research is an essential catalyst for the development of urban agriculture; it provides a clearer understanding of the industry's contributions and limits. Without this knowledge, credit and investment will be difficult to attract. Research institutions are thus crucial actors in urban agriculture (table 6.4).

International development agencies

Until recently, international assistance had not followed the growth trend of urban agriculture. In the late 1980s and early 1990s, even as more developing countries requested urban assistance and donor countries shifted policies towards supporting urban development, international funding for urban agricultural programmes still lagged behind. But interest is now increasing (table 6.5). In 1991, UNDP began the survey of urban agriculture in Asia, Africa and Latin America that has

Table 6.5 Examples of international agencies supporting urban agriculture

Organization	Location	Description of support
FAO, IDRC	Latin America	Support new regional network.
FAO	Global	Supports street food upgrading projects.
UNDP, FAO	Latin America	Support shantytown hydroponics projects.
UNDP/World Bank	Global	Support programmes in wastewater-fed fish and irrigation. Supported Urban Agriculture Initiative in 1991–93, and support for this book.
UNICEF	Global	Supports policy studies on household and community gardens.
United Nations University	Global	Funded Food-Energy Nexus Programme in the 1980s.
UN Centre for Human Settlements	Tanzania	Supports urban agriculture as environmental intervention in open space.
NRI/ODA	Tanzania	Support city centre and peri-urban vegetable production and training.
IDRC	Global	Funds urban agriculture surveys and research projects.
USAID	Philippines, Thailand	Supported urban agriculture in its Managing Energy and Resources Efficient Cities (MEREC) programme (1980s).
GTZ	Mexico City, Tanzania	Supports sewage-fed fisheries, composting composting and vegetable projects.
Italian government	Argentina	Supports community gardens.
SIDA	Mozambique, Ethiopia	Provided support for urban agriculture in the 1980s.
JICA	Philippines and other countries	Supports urban agriculture and marketing
Taiwanese government	Panama	Supports urban agriculture and provides fellowships for study in Taiwan.
Inter-American Foundation	Chile	Supported urban gardening programs.
Ford Foundation	Kenya	Supports Undugu Society, an NGO.
Oxfam	Peru	Supported Peru Mujer, an NGO.
Save the Children Fund	Central America	Supported local gardening.
CARE International	Haiti	Promoting entrepreneurship in urban agriculture.

Source: Compiled by The Urban Agriculture Network from various sources.

culminated in this report; since then, UNICEF, the World Bank, the Food and Agriculture Organization and CARE International have renewed or initiated programmes in urban agriculture.

**Which organizations influence
urban agriculture?**

Case 6.4 International agencies promoting urban agriculture in Tanzania

A coincidence of interests has attracted several international development agencies to urban agriculture activities in Tanzania. While the combination found there is probably unmatched in other countries, this case illustrates the range of interests and types of involvement possible elsewhere.

In the mid-1980s, the Canadian International Development Research Centre (IDRC) supported a major study by Sokoine University of the status of urban agriculture in six small, medium and large cities in Tanzania. The national census conducted in the same period found that one of every five employed adults in an urban census zone was working in agriculture. In the early 1990s, with this information and a national policy favouring food production in towns and cities, two major international development agencies initiated urban agriculture projects.

GTZ, the German bilateral aid agency, started a three-city project in 1993 called the Urban Horticulture Promotion Project. The objective of the project is to increase the consumption of vegetables in urban Tanzania and later in southern Africa by increasing production in urban and peri-urban locations. The project is under way in Dodoma, the new capital (photo 6.5); Arusha, a medium-size city in the highlands; and Dar es Salaam, a coastal metropolis of two million people. The first 18 months were spent collecting data and establishing relationships. The production phase began in 1995. Excellent relations have been established with the Capital Development Authority in Dodoma, which strongly favours urban food and fuel production.

At the same time, the British Natural Resources Institute (NRI), with backing from the Overseas Development Agency, was establishing one peri-urban and one in-town pilot urban agriculture project in Dar es Salaam. NRI established a collaborative relationship with Plan International, a UK private voluntary agency operating in the city. Like the GTZ project, the two NRI projects work with the Ministry of Agriculture and Land.

Another important project is the Sustainable Dar es Salaam Project of Habitat, which has been operational since 1993. It includes an open space subproject which is studying urban agriculture as a tool to maintain open space, conserve the environment and generate jobs. The IDRC is supporting the project by funding an effort at Dar es Salaam University that provides information about urban



Photo 6.5 GTZ's horticultural demonstration site in Dodoma

agriculture. Another university team is collaborating with the NRI and the GTZ on related urban agriculture projects.

Other international agencies have begun initiatives as well. The Danish development agency (DANIDA) is supporting low-income women in small urban agriculture entrepreneurial efforts in Dar es Salaam. The LIFE (Local Initiatives for the Environment) project of UNDP is supporting an urban farming project on Zanzibar island emphasizing youth participation. The Swedish aid agency (SIDA) recently studied cultivation in a small town in Tanzania. The Dutch government also has expressed interest in supporting urban agriculture in Tanzania. From these seeds, an integrated national urban agriculture programme may emerge.

Contact: L. Keith Lilley, Urban Vegetable Promotion Project, GTZ, Arusha, Tanzania; Luc Mougeot, IDRC, Ottawa, Canada; and Rudy Schippers, NRI, Kent, United Kingdom.

Some bilateral aid agencies have urban agriculture assistance programmes. The International Development Research Centre (IDRC) of Canada is the most notable. It has funded surveys of urban agriculture in Kenya and Tanzania, supported 18 projects in 13 countries over the past decade or so and held an international workshop in 1993. The centre is exploring the possibility of regional research programmes in Latin America and Africa. GTZ, the German bilateral aid agency, has a groundbreaking project in Tanzania (case 6.4), and Italy supports a large project in Argentina.

Studies and workshops initiated by international agencies are helping to gain recognition of urban agriculture as an important and legitimate activity; they also provide concrete information on which governments can base policies.

In some cases, international agencies provide financial resources. For instance, the African Development Bank contributed to a major urban fuel wood project in Ethiopia. Others lend their assistance to specialty crops; the Food and Agriculture Organization, for example, has funded mushroom cultivation in Ghana. Over the past couple of decades, international agencies have supported important research in wastewater and solid waste management and established standards for the use of urban waste as an input to food production.

As the aid community shifts its focus to sustainable development, sustainable agriculture and sustainable human settlements, it is beginning to discover the synergistic role that agriculture plays in towns and cities. International development agencies can contribute most effectively in certain cross-national areas, in particular, model codes and regulations, the introduction of new crops and standards for use of chemicals and waste inputs.

Other stakeholders

As chapter 1 showed, urban agriculture requires the participation not just of the producers themselves (the farmers), but also of various other participants in the preproduction and postproduction processes. Thus a number of actors currently or potentially have a stake in the urban agriculture industry, including input providers (such as seed suppliers), banks and credit agencies, food processing companies, landlords, wholesalers, distributors and marketers and recyclers and waste managers. Some of these stakeholders are highlighted here.

Urban farmers operate between two relatively well-organized economic subsectors: agricultural inputs and food marketing. The relatively unorganized, disparate, small-scale producers are flanked by relatively well-organized agribusiness input providers and relatively well-organized public, municipal or private markets and marketing systems. It is our impression, from visiting both countries where urban agriculture functions as an integrated industry and those in which it is a cottage industry, that the participation of miscellaneous “other actors” is vitally important in these non-production aspects of urban agriculture. They play an especially significant role in encouraging producers to move beyond growing for family and friends, as is illustrated by the experience of livestock producers in Manila (see case 9.5).

Most agricultural subsectors are oriented primarily towards serving the needs of rural farming, making it difficult for urban farmers to access these subsectors efficiently. Producers of agribusiness inputs (such as seeds, feeds, fertilizers, tools) manufacture for the rural market and do not cater to the needs of small urban producers. Similarly, municipal and district waste managers generally fail to take note of the large processing capacity and market for organic waste that urban farmers offer. Nor do many municipal markets and supermarkets consider small local producers when obtaining supplies, turning instead to large-scale suppliers or wholesalers that purchase mostly from rural farmers. Canneries, slaughterhouses and other processors also tend to overlook small-scale urban suppliers.

Private corporations can play the role of “institutional providers” discussed above. For example, a factory can allot space to its workers for small gardens, or a restaurant can give its organic waste to its workers for use as fertilizer. In Jakarta, the municipal government has issued

specific requests to private corporations to make “sleeping land” available to community farmers on a usufruct basis.

The horse-racing club in Jakarta described earlier is an outstanding example of a multipartner arrangement. Farmers are allowed to produce agreed crops on the margins of the racetrack in return for collecting and processing the waste. The neighbourhood has agreements with the same farmers to collect and compost their waste as well. The farmers have access, in trade of services, to land, organic waste, water and a strong iron fence.

Wherever urban farming is dominated by small producers, agriculturists face high sales costs unless the market is organized to their requirements. Urbanized economies like Taiwan (province of China) and the Netherlands have efficient markets through auctions run by farmers associations. However, in most cities, wholesalers are not adapted to the needs or opportunities of the small urban producer.

Marketing urban produce involves many actors. In some places, NGOs and governments assist small farmers by establishing farmers markets. The Jerusalem producers cooperative outside Bogotá has a joint marketing board consisting of eight cooperative members and four members from a supermarket chain.

Efficient marketing requires market information. Weekly radio programs, as well as other media, provide information about the latest techniques, neglected crops and the shifting pattern of the urban market. Agents, such as shippers, food processors, street vendors and sellers and buyers of compost, also play a role. Much is still to be learned and documented on the interaction between these actors and urban food and fuel producers. Only street food providers have been seriously studied so far.⁹

Finally, credit providers, including banks, credit unions and farmers associations, are essential because farmers must always invest in advance of the harvest. And it often takes years for farmers to see a return on an investment in capital improvements. Yet farmers often find it difficult to obtain credit for a number of reasons (see chapter 9).

Still, a few banks and other organizations have successful urban agriculture lending programs. An outstanding example is the Cooperative and Rural Development Bank of Tanzania, which in the past several years has made hundreds of loans, primarily to middle-income farmers. Similarly, the Taiwan National Farmers Association is an

excellent model as a credit provider from within the farming community. All members in good standing have access to credit with streamlined procedures. The risk is reduced by the large membership and reinsurance by the national government. Finally, many of the small loans made through micro-lending funds such as the Trickle-Up Program are used by very small urban food producers to purchase essential tools to expand. The Trickle-Up Program is a small American NGO which makes small grants to entrepreneurs substantially on the basis of a completed business plan.

Partnerships among organizations

A wide range of partnership models exist. Partnerships can be created (a) between farmers and private business, (b) between farmers and NGOs or institutions, (c) between farmers and government and (d) between governments and international interests.

Partnerships between farmers and private businesses are typically farmers associations or cooperatives and production relationships between large firms and small producers (for example, outgrowers). Farmers' partnerships with NGOs and institutions are commonly organized to ease access—to markets, inputs, land, extension and so on. Partnerships between government and farmers vary widely and are formed mainly around common needs of access to land, water, markets and information and extension. International partnerships at their simplest are with agribusiness for production or with aid groups for inputs and technology and information.

Partnerships between agribusiness and small farmers are usually outgrower relationships. These require government oversight to ensure the rights of the farmers. These partnerships can be arranged and managed through NGOs and may have a public-private board of directors.

Farmers associations sometimes represent only small farmers and sometimes both large and small farmers. In other cases, they include manufacturers and marketing organizations. Community organizations, including women's and youth groups, are active in supporting urban farmers and frequently are linked to non-governmental organizations at a national or state level. Community organizations often work in partnership with local government as well as with the farmers and NGOs.

Research organizations, frequently related to a university or a national department of agriculture, are normally found in partnership with farmers associations and with NGOs. Less commonly, they provide direct assistance to urban farmers.

Non-governmental organizations at the state or national level are the most ubiquitous members of partnerships. NGOs are in partnership with community organizations, local governments, national governments, international organizations, research organizations and banks. NGOs may in fact be the most vital partner that urban farmers can have.

National government agencies also have a wide range of partnership roles to play. In the areas of policy, enabling legislation, technology and credit, national governments hold great power over the viability of urban agriculture. Frequently, they are also important for international links.

Regional and international networks and organizations will be important partners during the next few years as the industry matures. The right lessons can be learned expeditiously from other countries and regions through international partners. Finally, partnerships with banks and credit unions are vital to the health of the industry.

Productive partnerships can do much to promote urban agriculture, as some examples illustrate:

- ▼ In Manila, the Urban Food Foundation persuaded Del Monte Corporation to buy from hundreds of small outgrowers rather than maintain its own plantations.
- ▼ In Calcutta, a fishers cooperative working with the metropolitan sewer and water authority and the port authority doubled production and improved quality.
- ▼ In Peru, the ministries of health and agriculture work with community kitchens and CARE International to enable the members to produce their own vegetables to supplement the contributed rice and beans.
- ▼ In Bogotá, Colombia, a women's cooperative in the low-income area of Jerusalen has a partnership with a supermarket chain and the local municipality; this partnership was facilitated by UNDP.
- ▼ In Baltimore, Maryland, two student researchers work on urban forestry issues through a programme with the Yale University School of Forestry and Environmental Studies.¹⁰



The many government, institutional and agency interventions in urban agriculture documented here are but a fraction of the global activity in this area. This volume does not even consider the organization of urban agriculture in North America and Europe, even though urban agriculture is particularly well organized, especially in Europe.

Lamentably, there has been little collaboration to date among organizations active in the field. Our hope is that in the not-too-distant future, there will be strong, mutually beneficial links between urban farmers in the south and those in the north, and that all concerned institutions can help bring about a new day of cooperation and sharing. The possibilities for such interactions are explored in chapter 10.

Notes

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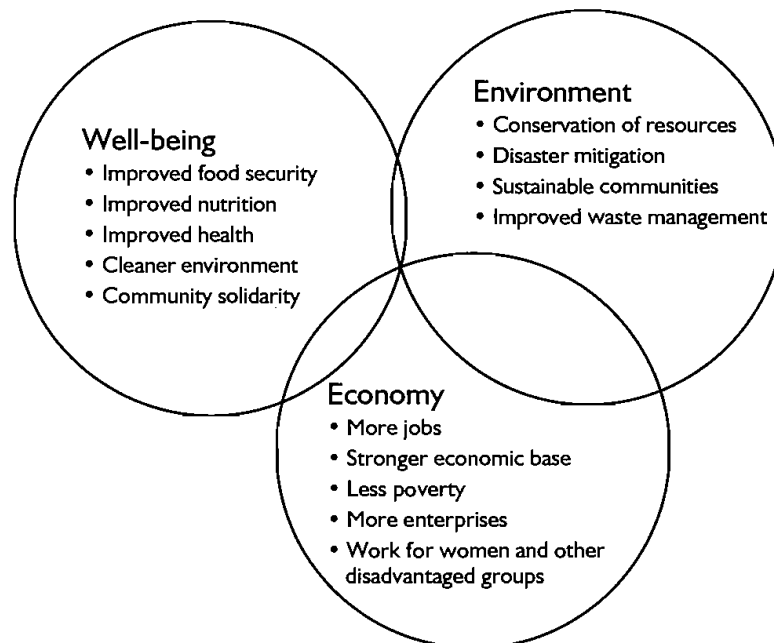
**Benefits, problems
and constraints**

The benefits of urban agriculture

Urban agriculture provides benefits to the economy, the environment and the well-being of both those active in the industry and to residents of the town or city (figure 7.1). It has a role to play in programmes and projects that target health and nutrition, the environment, enterprise development, income generation, water and sanitation, youth and women and food production and supply.

The current and potential role of urban agriculture differs from country to country and depends on the particular country's circumstances. In countries that must export agricultural products to earn foreign exchange, urban agriculture can feed the cities while rural

Figure 7.1 Main contributions of urban agriculture



Source: The Urban Agriculture Network.

farmers concentrate on exports. In countries with a fragile ecology, urban agriculture's intensive production technology and its capacity to absorb urban wastes may be essential to averting environmental disasters around urban regions.

Health, nutrition and food security

Factors that influence the health and well-being of individuals include the quantity, quality, regularity and nutritional balance of their food intake, as well as the quality of their living environment. Urban agriculture contributes to the health and well-being of a community by reducing hunger, improving nutrition and improving environmental conditions that affect health (table 7.1).

The World Bank and others have developed "healthy days of life" and other quality-of-life indicators to measure a society's health and well-being. Studies indicate that 40–75% of adults and children living in low-income urban areas in poorer cities have diseases that limit their capacity to learn and work.¹ By reducing hunger and malnutrition, urban farming makes the urban poor healthier, more productive and more resistant to diseases. In addition, farming activity cleans and greens the living environment, reducing pollution and disease-causing pathogens and vectors in the environment. Household waste and refuse can be recycled for agricultural uses, providing additional environmental benefits.

The benefits offered by urban agriculture are both quantitative and qualitative: enhancing the quantity of food available reduces hunger, while improving the quality of food fosters better health and nutrition. Nutritionists have determined that the dietary intake of preschool children is an important factor for healthy mental and physical development. Hunger and nutritional deficiencies can lower productivity, reduce health and shorten life. Hunger can occur as a result of poverty or as a result of inadequate food supply and a distribution system that both increases the cost of, and reduces the physical availability of, food. In some social groups, women and female infants may be given less food than male members of the family, making them particularly prone to hunger and malnutrition.

For the poorest with unstable incomes, daily dietary intake varies depending on that day's income and on prices in the market. They may thus suffer from hunger for part of the year. Urban poor, far

Table 7.1 Examples of the impact of urban agriculture on health, nutrition and food security

Country	Impact
AFRICA	
Kenya	Twenty-five percent of the country's urban population is dependent on self-produced food for nutritional survival.
Uganda	In Kampala, children of low-income farming families are as healthy as children of wealthy families and healthier than children of non-farming low-income families. Save the Children Fund recommended that supplementary feeding programmes in low-income areas of Kampala were not needed and noted that urban food production was a factor in Uganda in the late 1980s.
Zambia	Severe economic crisis led to increased food production in Lusaka. By 1977, 43% of one low-income community was farming home gardens and 57% was farming other city farms—saving 10–15% on food costs. According to a 1994 report, 80% of families farm in some low-income neighbourhoods.
ASIA	
China	In Shanghai, vegetables grown in the metropolitan area reach market within ten to 15 hours of harvest.
Indonesia	In Java, home gardens supply about 18% of caloric consumption and 14% of proteins for residents.
Nepal	In Kathmandu, 37% of households polled in a survey reported that they met plant food needs through household production. In the 1980s the average plant food production consumed directly by households was 72%, and the average animal food was 86%. Forty-one percent of average daily food intake was derived from household production.
Philippines	On the island of Negros, malnutrition among urban and rural children dropped from 40% in 1988 to 25% in 1990 after the start of biointensive gardens. In Cebu City, horticulture combined with public health interventions increased vitamin A levels significantly among children and provided other nutritional benefits that supplementation and fortification interventions alone did not provide.
SOUTH AMERICA	
Argentina	In Buenos Aires, 20% of the nutritional need of the city is produced by part-time farmers. Urban farmers consume 70 kilos of vegetables per person each year, while their non-farming neighbours consume only 30 kilos.

Source: Compiled by The Urban Agriculture Network from various sources.

more than rural poor, are dependent on cash income to purchase food. Moreover, the poor often pay more for food than richer urban residents because they purchase small quantities rather than bulk and pay more in transportation and time to reach cheaper sale points.²

The locus of poverty is fast shifting to urban areas. By 2000, close to 2.5 billion people will be living in cities, more than half of them in poverty.³ Persistent and chronic hunger are increasingly more urban than rural problems. In most low-income cities, expenditures on food take a substantial bite out of household income. The poorest households spend 60–90% of their income on food—and face hunger as a result.

Urban agriculture can contribute significantly to combating urban hunger and malnutrition in the following ways:

- ▼ Self-production and barter increase the food security of the poor by making it possible to obtain food they could not otherwise afford—even during bad financial times. Because daily food intake does not depend on their unstable daily income, poor families gain control over the quantity, quality and stability of their diet.
- ▼ Urban agriculture provides the poor with control over the nutritional balance of the family diet. More expensive food items, like fruit, vegetables and meat, are supplied through home production. The improved nutritional balance reduces protein and energy malnutrition as well as deficiencies of essential micronutrients and vitamins.
- ▼ It provides fresher food. Food from outside the city—especially perishables like fruit, vegetables and fish—loses much of its nutritional value in transit and storage.
- ▼ Local production may bring down food prices due to the savings resulting from fewer middlemen and less transportation and storage. Local production makes food available in the neighbourhood and thus improves physical access.
- ▼ By reducing the cost of food, urban farming makes income available for other expenditures, including health and education.
- ▼ In many countries, urban farmers are more likely to be female than male. Thus urban agriculture helps ensure children's access to food and contributes to empowering women.

Governments and development agencies have used various strategies to address the problems of hunger and malnutrition, including food subsidies; food stamps; school children and mother feeding programmes; and targeted distribution of iron, vitamin A supplements and iodine tablets. Most imply high and continuous costs to the state. As a strategy to combat hunger, promoting farming in poor urban neighbourhoods is more cost-effective and more empowering than providing food aid.

Producing their own food is a food security strategy for millions of urban poor around the world. A majority of urban farmers (70% in Kenya) are low-income agriculturalists, producing for home consumption.⁴ In Jakarta, almost one-fifth of the food consumed by squatters is self-produced; in Lusaka, one-third.

In the city of Shanghai, production and supply of vegetables is managed so that the vegetables reach the market within ten to 15 hours of being harvested (see case 6.2). A striking example of the nutritional impact of urban farming is provided by a study in Kampala, which found that children of low-income farming families were as healthy as children of high-income families and healthier than children of non-farming poor families.⁵

Where farming by the poor has been systematically supported by development agencies, long-term and sustainable benefits are reported, as shown in two Philippine cases. In Negros, malnutrition was reduced in two years from 40% to 25% among families of participants in a programme that promoted biointensive home gardens.⁶ In Cebu City, horticulture, as a public health intervention, provided more significant increases in vitamin A levels among children (as well as other nutritional benefits) than other, more standard supplementation and fortification interventions (for example, targeted supply of iron, vitamin A, iodine tablets).⁷

In Haiti, CARE International has a project to assist the poorest urban residents to grow food for consumption and sale. Also in Haiti, Educational Concerns for Hunger Organization of Florida is assisting poor residents to grow vegetables intensively in shallow beds on rooftops (see case 5.4). In Kenya, the Undugu Society is helping poor families grow vegetables and fruit and raise livestock to improve the nutritional self-reliance of poor communities (see case 6.1). In Lima, Peru, families are experiencing nutritional and other benefits from urban farming (case 7.1).

Home gardens as nutritional solutions have been promoted by several international agencies—including UNICEF, Save the Children, the Mennonite Christian Committee, the American Friends Service Committee and Oxfam—especially to increase the vitamin and micronutrient intake of mothers and growing children. The US Agency for International Development's Vitamin A Field Support Project (VITAL) reports several studies that found a significant increase in vitamin A consumption is related to home gardens.⁸ However, most of these programmes target only the rural poor, in



Photo 7.1 Community kitchen in Lima that uses produce grown in community gardens to improve the nutritional quality of meals

many countries leaving out the majority of food-insecure poor—the urban poor.

Case 7.1 Growing food for community kitchens in Lima

Community kitchens (*comedores populares*) in Lima, Peru, run mainly by women, serve cooked food to their members, who are predominantly from poor communities. Traditionally, rice, beans and oil are subsidized by the government and international aid; kitchen members raise small livestock at home for use in the kitchen.

In recent years, CARE International has collaborated with HUFACAM (the division of the Ministry of Agriculture that promotes urban farming) and the Ministry of Health to promote community gardens for the *comedores*, which grow vegetables and fruits to improve the nutritional quality of the food served. These gardens, typically 100 square metres, are on government land—in small parks and at health centres and playgrounds, for example. CARE provides seeds and a technical expert. The government provides a social worker who helps organize the farming activity. In some cases, CARE and the government assist with access to water. The farmers use household and street waste, as well as the manure from their home livestock, to enrich the soil. Facilitating health workers report that the gardens have immense nutritional benefits and help create self-reliance and empowerment within the communities.

Contact: Manuel Orozco Ramos, P.E., HUFACAM, Ministry of Agriculture, Lima; Lucila Alegre de la Cruz, Microenterprise Director, CARE International, Psje. Estados Unidos 131-A, 3er. Piso, Comas, Peru.

The benefits of fresher food from local production are available not just to farmers' families but to the entire city. Too often, market



Photo 7.2 Fresh meat being sold at a farmers market in Managua

fruits, vegetables and meats go bad due to long journeys to market and lack of proper storage. Urban agriculture helps make available fresher produce and meat. Middle-income kitchen gardens, a common sight throughout the world, contribute to improving the nutritional status of middle- and higher-income families.

Nutritionists have been surprised that in some cities, even civil war or economic crisis has produced relatively little additional urban hunger. In Kampala, Uganda, in 1981 (after the civil war), UNICEF found that urban agriculture, a virtually undocumented phenomenon, was substantially feeding the city in non-cereal foods.⁹ Similarly, in Kinshasa in 1991, after Zaire's economic collapse, malnutrition was less prevalent than might have been expected.¹⁰ In Baghdad and Sarajevo in the 1990s, residents have turned to gardening to provide for their nutritional needs.

Social benefits

Urban agriculture's benefits for farmers and their families are a springboard for its benefits to society. Urban farming improves social equity by improving the health and productivity of poorer populations and by providing them an opportunity to earn additional income. The health, income, environmental and other benefits of urban agriculture for low-income farmers all make strong positive social contributions.

Urban agriculture helps reduce urban poverty in a number of ways. First, it provides fungible income. Since food is by far the largest component of household expenditures, any saving on food makes a significant portion of income available for non-food purchases. Second, because it is entrepreneurial, it produces profits and jobs. Third, the nutritional and environmental benefits result in more productive individuals, capable of enhancing their own well-being and that of their families. Finally, children, who are most prone to malnutrition, get an increased and improved diet, especially when the farmers are women.

The poor are not one large, shapeless, vulnerable group. Some are more vulnerable than others. Urban agriculture often helps the weakest members of poorer communities disproportionately; this group includes women, migrants, immigrants, refugees and people in long-term civil crises (see chapter 3). The work opportunities provided by urban agriculture generate employment and income for those who have the fewest employment opportunities in urban areas. Urban agriculture is a way for people in these groups, and for day-wage earners and the unemployed, to become entrepreneurial. Women growing hydroponic vegetables in the slums of Bogotá, for example, typically produce incomes that exceed their husbands' salaries (see case 5.5). Youth have learned through urban agriculture projects, such as the Peace Corps project in the Dominican Republic, not only to achieve



Photo 7.3 Community gathering in Sagbe, Abidjan, for the smoking of locally caught fish

stable income but to become accountable for their communities' environmental well-being and food security.¹¹

Urban cultivation is frequently undertaken through community organizations, in other words, by collective entrepreneurs. When successful, such community efforts in urban agriculture are an effective means of empowerment, as the International Food Policy Research Institute found through a home gardening project it studied in Guatemala.¹²

Urban agriculture also contributes to a community's well-being by improving its aesthetics and solidarity. Neighbourhoods that include urban agriculture have a higher level of social interaction and better security, in part because the activity is on the streets rather than behind closed doors. Neighbours tend to share a concern for the success of the enterprise and often the fruits of its labour as well.

Finally, to the benefits already identified must be added a less tangible, less direct one: individual empowerment. Peru Mujer's experience shows the improvements that urban agriculture can bring to women's lives beyond nutrition and income: better self-image, higher standing within the family and elevated social and economic position within their community (case 7.2). This benefit is especially important since a high percentage of urban farmers are women.

Case 7.2 Social benefits of urban farming supported by Peru Mujer in Lima

Peru Mujer, a non-governmental organization (NGO) working with low- and middle-income women in Lima, Peru, and a few up-country towns, administers a comprehensive and well-planned community gardening programme that contributes to improving the food security, nutrition and health of 5,000 families.



Photo 7.4 Training facility operated by Peru Mujer on hospital grounds in Lima

On average, the community gardens consist of 40 plots of 60 to 200 square metres. Most are farmed by women, who grow biointensive vegetables mainly for consumption. Peru Mujer provides training and extension as well as marketing and processing support. It also creates organization and leadership structures among the farmers. The NGO has been particularly successful in negotiating access to land and water and arranging for the land to be fenced to protect the gardens from theft and free-grazing cattle. At some sites, watchmen are engaged.

Peru Mujer develops its own training manuals, covering not only the technical aspects of farming but also nutrition and health issues. It has a good relationship with the government: one training facility is on the grounds of a government hospital, and several community gardens are on public land.

The activities of Peru Mujer are funded by local and international organizations, including Oxfam and the Ford Foundation.

Contact: José A. Dasso, Peru Mujer, Lima, Peru (see appendix F for complete address).

Economic benefits

The economic importance of urban agriculture has received little attention to date. Scholars have tended to regard it as a subset of either rural agriculture or the informal sector, or as a temporary phenomenon. The available data suggest, however, that the economic benefits of urban agriculture are at least as great as the nutritional and environmental benefits.¹³

Urban agriculture strengthens the economies of towns and cities by adding a substantial industry that supplies a basic demand item—food, especially vegetables, poultry, milk, fish, fruit and livestock. The input, production, processing and marketing activities linked to urban farming create considerable economic activity in the city.

Urban farming is a competitive economic activity and the industry of choice of millions of urban entrepreneurs. It also provides income-generating opportunities for people with low skills and little capital, as well as for people with limited mobility, including women with children and aged persons. For many private and public entities—including port authorities, hotels, restaurants, airports, municipalities and electric and water utilities—it provides opportunities for secondary incomes.

Urban agriculture often utilizes unused resources in the city—wastewater, solid waste, vacant lots, bodies of water and rooftops. It puts idle land to productive use, either by paying competitive rent or through usufruct use, and maintains the land in good condition for the owner. For countries with foreign exchange problems, urban agriculture can be an import-substituting industry.

The economic benefits of urban agriculture can be discussed in terms of its role in three areas: (a) employment, income generation and enterprise development; (b) the national agriculture sector and urban food supply and (c) land use economics.

Employment, income generation and enterprise development

It is not surprising that both low- and high-income entrepreneurs choose urban farming as their industry. Because food is the most basic consumption item—the industry with the most stable and dependable demand, even during economic downturn—it reduces the risk of the enterprise. Because they are close to the market, urban farmers can tailor their production to market demand and supply high-value and perishable items. Closeness to the market also gives farmers a competitive advantage through savings in transportation and storage costs.

Whether small or large, legal or illegal, informal or formally recognized, urban farmers around the world are producing competitive incomes through farming (table 7.2). In Jakarta, a group of farmers runs a profitable vegetable farm on land allotted in return for services inside the grounds of a racetrack. Poultry farms holding a few thousand birds are a common sight at the outskirts of many cities.

Urban food production has a significant multiplier effect on the city economy; it generates economic activity in related industries, including those that supply agricultural inputs (such as fertilizer, seeds, feed and extension services), as well as storage, transportation, canning, marketing and food processing industries. Street food vendors in



Photo 7.5 Small-scale ornamental horticulture production and retail at a roadside near Dakar.

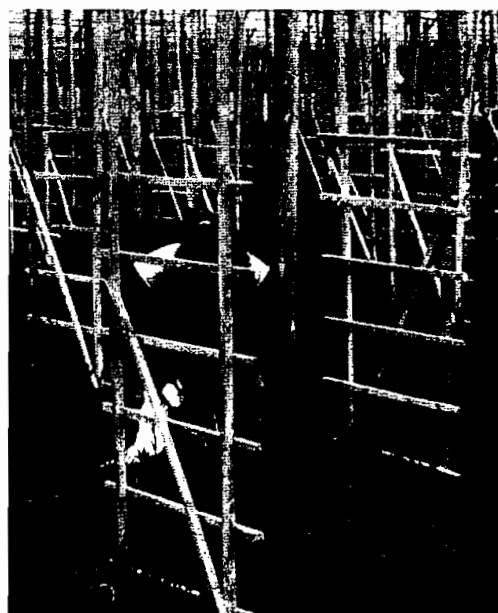


Photo 7.6 Large ornamental horticulture enterprise in Bogotá

Table 7.2 Examples of the impact of urban agriculture on job and income generation

Country	Impact
AFRICA	
Tanzania	In Dar es Salaam, urban agriculture was the second-largest employer in 1988, after petty trading and labour. Twenty percent of working-age adults participate in urban agriculture.
Zambia	The average annual income of participants in a programme to expand and improve food gardens in Matete nearly doubled in two years.
ASIA	
India	Intensive farming on 800 hectares of garbage dumps in Calcutta employs about 20,000 people. Fisheries in sewage-fed lagoons employ 4,000 families and produce 6,000 tons of fish every year.
Thailand	In Bangkok, a poultry conglomerate contracts to approximately 10,000 outgrowers.
NORTH AMERICA	
United States	Kona Kai Farms in Berkeley, California, made \$238,000 in 1988 through sale of organic specialty greens grown on a half acre. Three employees are starting their own garden farms.
SOUTH AMERICA	
Argentina	In Buenos Aires, backyard gardens can provide 10–30% of the cost of a nutritious diet.
Colombia	Urban hydroponics supported by UNDP generate approximately US\$30 per month on 10 square metres and require only one hour of daily care. Up to two monthly minimum salaries (US\$90–\$180) can be made on 30–60 square metres of planting.

Source: Compiled by The Urban Agriculture Network from various sources.

Bangkok and elsewhere grow their own food and cook it for sale every morning.¹⁴ In Bamako, Mali, entrepreneurs supply compost excavated from garbage dumps to meet farmers' demand for fertilizer.

Urban farming provides secure jobs to many in the city. In some cities, as many as one-fifth to one-third of all families are engaged in agriculture, with as many as a third of these having no other source of income.¹⁵ Tanzania's 1988 census found that urban agriculture was the second-largest employer in the district of Dar es Salaam, with a population of about two million. (The first source of jobs was "petty trading and labour".) One in five adults of working age in Dar es Salaam is a farmer.¹⁶

But urban agriculture is frequently not recognized in labour statistics or included in economic data collection. Urban farming often goes unreported; individuals may not count their self-employment

in farming as a job, and statistical surveys may ignore the money a family saves by growing food at home.

In greater Bangkok, the Choroe Polphord conglomerate has contracts with no less than 10,000 poultry outgrowers. A great many of the outgrowers are small-scale entrepreneurs who provide employment to others. In Manila, the Urban Food Foundation farmers cooperative includes 500 small-livestock producers. Thousands of such examples exist globally (case 7.3).

The urban farmer has a competitive advantage in specialty crops and specialty markets such as the export market. Food processing and marketing corporations benefit from purchasing from urban farmers; the proximity ensures better contact and control over supply and quality as well as lower transportation costs, especially for perishable food items such as mushrooms. Del Monte Corporation purchases fruits and vegetables from more than 100 small outgrowers in Manila (see case 3.4).

Case 7.3 Integrated urban farming in Pikine, Dakar

In the community of Pikine in Dakar, Senegal, a cooperative of small entrepreneurs has succeeded in farming in an unbuildable, wetland area of tribal land. The farmers, who are mostly men, grow vegetables under trees and raise livestock, primarily for the market. The marketing is done by women. Both men and women process and market related products such as dried fish, tanned leather and handicrafts made of palm frond. In addition, the marshier parts are leased to rural itinerant rice farmers and the rent used for common projects.



Photo 7.7 Drying fish in Pikine, Dakar. The waste is reused as compost for vegetables.

The farmers follow sustainable agricultural practices, using waste from households, markets and animals to fertilize the soil. In some cases, wastewater is deflected from sewage pipes to irrigate the crops; in most cases, water for irrigation is lifted by hand from shallow wells.

The animals are raised in the home compounds and grazed in turn by tribe members on roadsides and vacant land. The women marketers buy fish from fishermen, process the fish and barter the waste to the farmers for fertilizer.

The farmers cooperative operates under the leadership of an elected president, who is also their tribal chief (photo 5.4). The farmers receive political support from the city mayor and technical assistance from the Centre pour le Développement de l'Horticulture, a government research institution working on horticultural techniques such as raised-bed monocropping. The institution is partly funded by the Food and Agriculture Organization.

The success of the farming activity stems from a strong organizational structure and the integration of marketing, processing and land management.

Contact: Dr. Amadou Mochtar Diop, Rodale International, B.P. A237, Thies, Senegal.

Large enterprises employing farmers or maintaining outgrower contract relationships with them bring to the farmers the benefits of organization and scale economies. The agribusiness organizes marketing, financing and technical assistance, allowing the farmer to concentrate on production. The farmer is also ensured the purchase of all his produce so long as it fulfills the quality-control requirements. The large enterprises utilize their size to gain access to markets and market information as well as credit—difficult for small, individual farmers to obtain.

Urban agriculture is an easy industry to enter. It can be started on a small scale, on informally accessed land (paying no or little rent), with few and inexpensive inputs and limited technical knowledge and skills. The output at this stage is usually low and inefficient, but an enterprising farmer can, over time, improve the inputs, increase skills and knowledge, enhance the efficiency of production and widen the scale of the activity—all with small incremental investments. However, poor farmers have little or no financial capacity to absorb economic shocks, especially when they have little official support.

Urban agriculture provides opportunity for unskilled youth, homebound mothers and the aged to participate in commercial activity. In Lusaka, for example, urban agriculture provides jobs for those whose skills do not qualify them for formal sector jobs—including women, teenagers and retirees—at a higher rate than other informal sector activities.¹⁷ Much urban agriculture work can be done at any time of the day; there may even be certain advantages to working outside busi-

ness hours (butchering, harvesting for later the same day or next-day sale). Many tasks can be done on weekends.

In Maipú, Chile, on plots as small as ten square metres, gardeners produce herbs and spices, which they process and package at home. The most dramatic example of enterprise development is probably that of a multi-millionaire urban agriculturist who began by selling eggs door-to-door, from chickens he raised on his parents' back porch in Jakarta (case 7.4).

Case 7.4 Income generation and enterprise development in Jakarta

In the early 1970s, Bob Sadino, a young high-school graduate in Jakarta, Indonesia, recognized the market for specialty food products and began a business that has turned into a multimillion-dollar urban agriculture success story. He began by importing chicks from the Netherlands, raising them in his parents' backyard and selling the eggs door-to-door to neighbours.

Sadino expanded his business activity rapidly, selling chicks to other poultry farmers and dressed chicken to luxury hotels while continuing the door-to-door sale of eggs. In about four years, he had established a retail sale outlet in his family home and then purchased a meat processing plant, where he processed chicken as well as other meats.

Within a few years, Kem Chicks concentrated on processing, wholesaling and retailing. The enterprise produces specialty products for which there is less competition; high quality and reliability allow the company to command higher-than-market prices. A national or international expert is generally called in to set up production and train staff in new products. Kem Chicks also provides support to its medium- and small-scale outgrowers.

Kem Chicks now also includes a hydroponic vegetable farm, established with the help of a Japanese expert, and field farms of vegetables in the peri-urban area. High-value, rare vegetables are grown for the market and distributed overnight after harvesting to maintain freshness.

Kem Chicks exports several food products, including dried fruit, to Singapore. The company currently employs about 800 people in addition to the outgrowers.

Contact: Bob Sadino, Kem Chicks Homeshopping Centre, Kebayoran-Jakarta Selatan, Jakarta, Indonesia.

The economic base of cities is particularly strengthened because urban agriculture is counter-cyclical in nature. Food is a basic consumption item with a fairly inelastic demand. Thus even when the economy is depressed, urban farming can still sell its products.

The national agriculture sector and urban food supply

Urban agriculture not only contributes to improved economic conditions for individuals and families; it offers a variety of macroeconomic



Photo 7.8 Hawkers market in Nairobi. Such markets, whether organized formally (here with support from the Asian Foundation) or informally, provide crucial outlets for the products of small producers, improving the access of urban residents to fresh food.

benefits as well. In most countries, food is among the largest industries. In many places, a significant portion of food production occurs within urban regions, and urban farming is a well-established and extensive industry (see table 2.2). In addition to being the main source for non-cereal nutrition of a large proportion of the urban poor, in many countries urban farming satisfies a significant percentage of the urban food demand, comprising a fair share of the nation's agricultural industry.

The US Department of Agriculture found that one-third of the US agricultural product (in dollar value) is produced within urban metropolitan areas, on one-ninth of the agricultural land.¹⁸ Eighteen large cities in China produce 90% or more of their vegetable demand and a significant portion of their fish and small-livestock protein demand within their metropolitan regions,¹⁹ while Hong Kong supplies 45% of its vegetable demand. Urban agriculture is a major industry in these countries, in part through a policy decision to pursue urban food self-sufficiency.

In countries where food and fuel represent an even larger share of the total economy, urban agriculture may have an even more important economic share. Russia's small farmers produce 30% of its agricultural product on 3% of the land, and two of three families in greater Moscow farm on a small scale, up from one-fifth in 1970.²⁰ Kampala produces most of the poultry consumed by its residents. Bamako,

Mali, produces all of its vegetables, as does Ouagadougou, Burkina Faso.

In the urban areas of low-income countries, 40–70% of the family budget is spent on food and fuel (table 7.3), with the poorest people in those cities paying 60–90% of their budgets. Thus urban agriculture can make a substantial contribution to the economic activity of a community or city.

Urban farming is an integral part of the urban food supply in most lower-income countries. It tends to provide products that rural farming cannot supply as well—perishables that suffer in transport,

Table 7.3 Cities among the world's 100 largest metropolitan areas that spend 50% or more of household income by all income groups on food.

City	Country	Spending on food as percentage of income
Ho Chi Minh City	Viet Nam	80
Lima	Peru	70
Katowice-Bytom-Gliwice	Poland	67
Dhaka	Bangladesh	63
Kinshasa	Zaire	63
Bangalore	India	62
Calcutta	India	60
Guangzhou	China	60
Istanbul	Turkey	60
Lagos	Nigeria	58
Bombay	India	57
Pune	India	56
Algiers	Algeria	55
Nanjing	China	55
Shanghai	China	55
Wuhan	China	55
Harbin	China	54
Recife	Brazil	54
Beijing	China	52
Shenyang	China	52
Tianjin	China	52
Alexandria	Egypt	51
São Paulo	Brazil	50

Note: In a comparable number of cities, 40–49% percent of household income is spent on food.
Source: Population Action International, *Cities: Life in the World's 100 Largest Metropolitan Areas* (Washington, D.C.: Population Action International, 1990).

high-value crops that need close monitoring of the market and certain export crops that require rapid delivery when ready. It is thus complementary rather than competitive with rural farming. It contributes to the national economy and increases the efficiency of the food supply.

Urban farming is particularly important in countries where the national agricultural marketing infrastructure has failed to catch up with the growth in urbanization, in order to feed the cities. This is true in most rapidly growing cities in Africa. The importance of urban farming also increases when the rural food supply or the national agricultural marketing infrastructure is disrupted, as happened due to civil strife in several cities, including Baghdad and Sarajevo.

In addition to contributing to the city's food supply, urban agriculture helps low-income farmers produce food they cannot afford to buy. This, too, does not displace rural supply, as the poor have limited financial resources to purchase food from the market.

Most developing-country food imports are undertaken to feed the cities. Egypt and Tanzania are two well-documented examples of countries that import food with a priority for their urban population. Urban agriculture can substitute for some of the imported food and provide the benefit of saving foreign exchange.

Many developing countries face the late 1990s deeply in debt and with a poor foreign trade balance. For some of them, it is possible and appropriate to put their good rural agricultural land into export crops and to let the cities provide for their food and fuel needs as much as possible through urban agriculture (case 7.5). Self-reliant cities thus advance rural agriculture's export goals. Nicaragua's government, for example, has made a decision to earn foreign exchange in the next few years through agricultural exports.

Case 7.5 Urban farming for import substitution in Sri Lanka and Ghana

The economic consequences of the structural adjustment programmes of the 1980s are well known. In some countries, economic conditions had been worsening since the mid-1970s. One common response was to earn foreign exchange by exporting rural crops—the same crops consumed by urban areas. Policies were also instituted to encourage urban residents to grow their own food to save money and ease the economic situation (these efforts in Papua New Guinea and Zambia are described in cases 5.8 and 9.1).

Sri Lanka found itself in a balance-of-payments crunch because of the need to import rice, wheat and other foods. Import restrictions imposed to save foreign exchange resulted in price increases and a short supply of food. To ease the problems, the government encouraged the consumption of indigenous staple crops

including manioc, yams and dry grains, which urban residents farmed in school gardens and in their backyards.

In Ghana, Operation Feed Yourself had considerable success during its four-year life (1972–76) in reducing imports for manufacturing and feeding the cities. Plantain crops increased from 202,000 to 840,000 acres; for okra, the increase was from 18,000 to 42,000 acres. Urban farmers associations operating today date to this period and still focus on urban farming for self-consumption.

Contacts: For Ghana: Daniel Maxwell, Land Tenure Center, University of Wisconsin, 1357 University Ave., Madison, Wisconsin 53715; and Dr. Bede N. Okigbo, Director, UNU/INRA, Isser Building Complex, University of Ghana, Legon, Private Mail Bag, Kotoka International Airport, Accra, Ghana. For Sri Lanka: Julie A. van der Blik, ETC Foundation, P.O. Box 64, 3830 AB Leusden, Netherlands.

Finally, in a world that is facing the possibility of food shortages, an expansion in urban agriculture can reduce the pressure on rural land, especially the push onto new agricultural land. Intensified production methods mean that more people can be fed on existing cultivated land without putting additional stress on marginal lands.

Economic use of land

Urban agriculture is thriving in a variety of settings, from rich Tokyo to poor Kampala and from high-density Hong Kong to low-density Managua. Still, a common skepticism exists that agriculture cannot pay urban land rent and that it is inappropriate to provide urban infrastructure for agriculture. However, as discussed in chapter 4, legality of tenure, rather than the availability of land or the competitiveness of farming land use, is the main problem.

Urban agriculture is an economical use of land for a number of reasons:

- ▼ It generates income from temporarily available land at the growing periphery and at the renewing core.
- ▼ It puts idle water bodies, wetlands and steep slopes to productive use and maintains the land.
- ▼ It generates income from idle, unbuilt parts of oversized facilities (hospitals, factories, military bases, airports and so on).
- ▼ It is a compatible open-space use in parks, sports facilities, universities, roadside verges, utility rights-of-way, riparian and floodplains along rivers and bays, cemeteries and other locations.
- ▼ It is a competitive land use in many cases (for example, poultry farms and horticulture on the outskirts of cities).

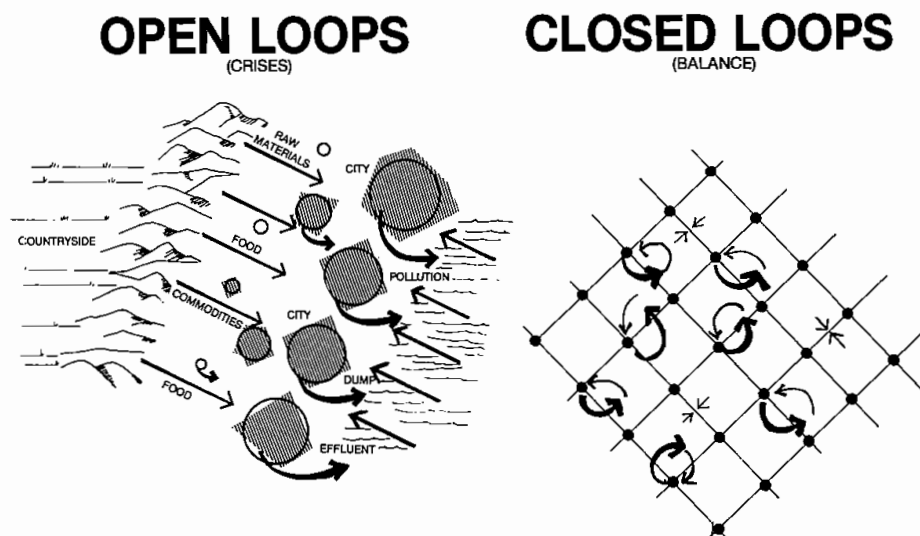
- ▼ Many urban farming techniques need little land space, and some generate a considerable number of jobs.²¹

Where the entrepreneur is using land solely for farming, it is likely to be a competitive land use. Where farming is a second use of the land, the opportunity cost of using that space for farming is much lower than the economic land rent. In the case of utility rights-of-way and public facilities (like airports) where land is held for future expansion, urban agriculture is mutually beneficial to the facility owner and the farmer.

The economics of urban land changes when urban agriculture is added to the mix of land uses. The usufruct principle—an additional productive use can be added to land insofar as it does not deny the current or future owners the benefits of ownership—plays a vital role here. The application of this principle increases the total rent that is available from land. Thus public and private organizations with excess space in their establishments can earn a second income by renting the space to farmers. Airport buffer and expansion areas can be farmed extensively for many years. In Jakarta, land under the elevated highways is leased to farmers. In West Bengal, the highway authority leases roadside land to rice farmers.

Urban agriculture may reduce the maintenance costs for public and private facilities; thus, for instance, roadsides and parklands, rather than being mowed, can be put to productive use. The electric utility

Figure 7.2 Two models of urbanization



Source: The Urban Agriculture Network.

in Rio de Janeiro leases space under the electric lines to farmers in return for maintenance of the land (see case 4.9).

Sustainable urbanization

Cities need to close the open loop of resources in, partial consumption, garbage out. In an open-loop system, natural resources, some as inputs to production and some as consumables, are imported into the urban areas and their remainders dumped as polluting waste into the bioregion (figure 7.2). To be sustainable, cities and towns must eliminate the “throughput” of resources in, garbage out.

Urban agriculture contributes to closing the open loop by re-using and transforming the by-products and waste of other industries (see figure 1.1). Urban farming increases local production, reduces imports and decreases the amount of waste discarded into the bioregion—and, by extension, the biosphere.

Since the 1960s, a number of modern models of ecologically sustainable human settlements have been proposed and sometimes tested in small experimental communities. These include the “organic house” (Berkeley, California), the “edible landscape” (Eugene, Oregon), “ecoville” (Dakar, Senegal) and “Auroville” (Tamil Nadu, India). Other approaches to sustainable urbanization now being considered emphasize trees, recycling, reduced consumption and infrastructural efficiency. Urban agriculture is integral to all these models and incorporates certain features from each one. Unlike these models, however, urban agriculture has emerged from a multitude of practitioners around the globe rather than through a theoretical construct, and it adds an economic dimension to the nutritional and environmental contributions of these models.

Urban agriculture contributes to the sustainability of cities by (a) enhancing the environment, (b) improving urban management, (c) contributing to waste management, and (d) conserving resources.

Environmental enhancement

In most low-income countries, rapid urban population growth and unmanaged expansion are degrading the environment not only of cities but also of their surrounding bioregions. The result is polluted air, water and soil; increased temperature; soil erosion; sharply reduced



Photo 7.9 Start of a reforestation campaign in Villa El Salvador, a suburb of Lima

biodiversity; and increased vulnerability to disasters such as floods. Urban farming can not only reduce the negative environmental impacts of urban growth; it can even contribute to improving the urban environment.

Urban agriculture cleans the air by reducing dust and absorbing pollutants through its foliage. It regenerates the soil by returning organic material and microbic life back to it. Particularly when urban forestry is included, the microclimate is improved through cooling and, in the case of arid climates, increased humidity. Trees cool by reducing radiational heating, which creates urban “heat islands” and converts groundwater into atmospheric humidity.

In studying the effect of urban vegetation on the city environment, the Chicago Urban Forest Climate Project determined that trees in the Chicago area removed some 6,145 tons of air pollutants in 1991, providing air cleansing valued at \$9.2 million.²² The trees sequester approximately 155,000 tons of carbon a year and provide residential heating and cooling energy savings that in turn reduces annual carbon emissions from power plants by about 12,600 tons. Shade, lower summer air temperatures and a reduction in windspeed by increasing tree cover by 10% could lower total heating and cooling energy use by 5–10% annually. The projected net present value of investment in 95,000 trees in Chicago is \$38 million, indicating long-term benefits that are more than twice the cost. These benefits accrue to all portions of the city, especially those that include urban forestry.

In developing countries, the quality of the environment is usually lowest in the low-income residence/mixed-use areas of cities for a number of reasons:

- ▼ These neighbourhoods are often settled at high densities and on land that is ill-suited to human habitation.
- ▼ The level of urban services is generally low.
- ▼ Low-income areas are often the “dumping grounds” for other portions of the city.

The living environment in these areas is unsanitary and unhygienic, increasing the incidence of diarrhoeal and respiratory diseases as well as the incidence of pests such as rodents, houseflies and cockroaches.²³

Farming in low-income communities has the potential to improve environmental health. It can turn unsightly lots into neatly cultivated areas, improve the hygiene of the area through using solid waste and wastewater in farming and reduce air pollution through greening. Local-level composting, if well managed, is an efficient option to reuse solid waste to enrich soils. Kitchen wastewater is used for crop irrigation by the poor all over the world. Household wastewater can be biologically treated for local irrigation use. Farming and trees in the slums also reduce the vulnerability of the community to disasters such as floods and landslides.

Residents of the slum of Kitui-Pumwani in Nairobi created a banana plantation to protect themselves from flash floods and produce income from the sale of bananas. They received help from the Undugu Society, an NGO that also promotes the use of local organic pesticides instead of imported chemicals. The residents compost their household waste to use for soil renewal and as a solution to the problem of waste disposal.

Eighty percent of Africans use fuel wood for energy, accounting for about 65% of the energy consumed. Current trends indicate a threefold increase in demand for fuel wood by 2020, creating the potential for serious shortages. More than 50 million people already face shortages. A large part of the demand comes from cities that will double their populations by about 2010. By 2000, urban populations will account for 50–75% of fuel wood demand in most countries in the region.²⁴ If the urban bioregions are not to be destroyed in the ever-expanding search for wood fuel, managed forestry in urban and peri-urban areas is imperative (case 7.6).

Some countries already practise urban forestry management for energy and other uses, but the practice must be expanded and improved. The Bandia forest in the Dakar-Mbour-Thies triangle in Senegal has been managed for fuel wood production since 1950.²⁵ Burkina Faso has managed the natural forests near Ouagadougou for fuel wood since 1981. Many towns in Sub-Saharan Africa have had green belts since the 1970s—plantations of eucalyptus around Ouagadougou; mixed forest for timber and fuel wood around Bamako; eucalyptus and other plantations in peri-urban Niamey; neem, rosewood, cail-cedra and acacia plantations around N'Djamena. The African Development Bank is funding a project to increase wood production for fuel wood in Addis Ababa.

Case 7.6 “Productive ecological settlements” in Ajusco, Mexico City

Ajusco is a forested, rocky region southwest of Mexico City, Mexico, where squatter settlements developed along the highway in the 1950s. By the 1970s, the area had become heavily degraded and polluted. The government, landowners and the real estate industry made repeated attempts to evict the squatters from the region. In 1980, the area was zoned by the city government as a “green”, or ecological conservation, zone. The decision was made to evict the settlements, restrict development and reforest the area to restore the ecological balance, reduce pollution in the city and replenish the groundwater aquifers.

To resist eviction, some squatter settlements decided to cooperate in the greening efforts and create ecologically sustainable settlements. The communities organized themselves and implemented programmes of tree planting, vegetable gardens and pollution control. University biologists and environmental NGOs provided assistance.

One settlement, known as Bosques, created an integrated “productive ecological settlement” involving reforestation, microlivestock, fisheries, mushroom farming and horticulture. The settlement planted more than 5,000 trees. As part of an integrated recycling system, compost and rabbit wastes were used to fertilize trees and vegetables.

The conservation and pollution-control efforts of the settlements convinced the Mexico City Federal District to adopt such activities as part of its ecological plans for the area and to allow the settlements to remain in the zone. The concept of ecological zones around Mexico City continues today.

The Inter-American Development Bank is assisting the district in preparing plans for two other mountainous areas (Guadalupe and Santa Catarina) at opposite sides of the valley, with a particular focus on sustainable air pollution reduction. As part of this effort, the bank has conducted cost-benefit assessments that found peri-urban reforestation to be an economical investment compared with other pollution mitigation techniques.

Contact: See source listed in appendix C.

Several cities in Sweden, the Netherlands, Japan and the United States have urban farming and forestry strategies. Trees lining avenues and on lots reserved as green space are common throughout the world; however, only a few cities—in Bangladesh, India, China, Chile, Argentina and Senegal, among others—plant trees that produce an income through fruit, fuel wood and other tree products.

The environmental benefits of urban agriculture are substantial. But when poorly practised, urban agriculture degrades the environment; its potential negative effects are addressed in chapter 8.

Efficient urban management

The role of urban agriculture in the management of towns and cities has been little studied to date. Urban farming can contribute to more efficient urban management; its benefits can help city managers overcome some of their most vexing problems, particularly in low-income areas.

In most low-income neighbourhoods, open spaces by roadsides, streamsides, utility rights-of-way, sites reserved for future schools and other vacant lots attract refuse and are unhealthy. Urban agriculture can serve to clean them and maintain them in an orderly pattern, use them for food production, green them to improve the quality



Photo 7.10 Attractive, well-maintained vegetable garden, San José, Costa Rica

of the environment and help free them of antisocial behaviour—all at very little cost to the municipality. The improved appearance of these sites is invariably a source of community pride.

In some situations, urban agriculture enrolls the poor in urban management. Lower-income groups assume responsibility for the environmental quality of their own neighbourhoods when they are provided the ways and means to do so and if they get a good economic return on their labour.

Community- and city-wide farmers associations, whose formal status and ties to the municipality may vary, contribute to management of riparian rights, land use, environmental quality, food quality and processing and marketing of food products. Urban farmers are also the “eyes on the street” and enhance security in the community as they protect their crops.

Large and small cities throughout the world include urban agriculture in their package of management tools. In São Paulo, for example, land use regulations encourage intensive farming of utility rights-of-way. In Mexico City, land and water farming are part of the city’s industrial and open space plans. Shanghai and other Chinese cities have in the past been self-sufficient in vegetable production by promoting managed farming (see case 6.2). In Bangkok, vacant factory sites are routinely rented on a short-term basis to small-scale farmers. In Dar es Salaam, floodplains within the city are



Photo 7.11 Sheep grazing on public land in Rome

intensively farmed by well-organized farmers associations. Rome has since antiquity allowed livestock grazing under usufruct arrangements to efficiently manage its open spaces (photo 7.10). In Rio de Janeiro, where periodic mud slides in slums on the steep slopes result in hundreds of deaths, the state government has initiated a forestry program to hold down the soil and provide incomes for the dwellers.

Field visits, interviews and published sources suggest that many Asian cities manage urban agriculture relatively well, as do some European cities. Latin American and African cities generally do not have well-organized systems and procedures to manage urban agriculture.

Urban agriculture that is not well managed and monitored can cause disease and pollute the land and water. Therefore, changes in administrative organization and operations are required when urban agriculture is introduced or expanded within a city. For example, governments may need to impose certain land use regulations on agriculture near industrial sites and along highways, prohibit certain fertilizers and insecticides near residences, hospitals and schools or permit only selected crops to use wastewater irrigation. Standards that are useful in setting such regulations are available from the Food and Agriculture Organization and the World Health Organization, among other sources.

Waste management benefits

From the earliest times, urban settlements have incorporated farming that utilizes the organic waste generated by the settlement. Maps of walled medieval cities show sizable areas within them being gardened, in addition to intensive horticulture and livestock beyond the city gates; urban wastes were delivered to these sites by oxcarts and handcarts. Similar waste management systems were practised—and continue in some measure—in China, Egypt, Mexico, India and Singapore.

In most countries influenced by the European and American style of development, by contrast, urban waste management and agriculture have been separated into the public and private sectors with relatively little interface: municipalities and special waste management districts manage waste; private farmers raise food, generally with no access to urban wastes as inputs.



Photo 7.12 Composting bin at a 75-year-old community garden in Zschortau, near Leipzig, Germany

At the same time, farmers have moved away from waste towards agrichemical inputs to nourish the soil. Yet the use of biological waste in urban agriculture has many advantages. It contributes to natural resource conservation, turns waste from a problem into a resource, reduces the public cost of waste management as the private sector gets involved and provides a better living environment, especially in areas not receiving waste management services.

Most cities today face acute problems in managing their waste, resulting in air, water and land pollution in cities and their bioregions. Wastewater and solid

waste collection systems are costly for the city administration, yet they do not currently have the capacity to service the entire city. Solid waste dumps are piling up, and landfill space is fast running out. Sewage discharge is polluting ocean estuaries, bays, rivers, groundwater and other water bodies. As a result of inadequate waste collection and processing, waste decomposes on the streets, causing pollution and public health risks.

A sustainable future for cities would require a move towards technologies that transform waste into useful products rather than dump it. Urban farming can contribute to this process in several ways: by producing crops for human and livestock consumption, by composting and by processing wastewater for direct production and irrigation. Some examples are listed in table 7.4.

For centuries, farmers the world over have used composted organic waste to fertilize and enrich soils and as a form of pesticide. Some city governments, such as Shanghai and Jakarta, have developed citywide programs to collect, compost and sell organic waste. Similarly, a number of cities—in India, Israel, Jordan, Mexico, Morocco and Tunisia and in the state of California in the United States—use treated urban wastewater for irrigation of urban and peri-urban crops.

Table 7.4 Examples of urban agriculture's waste management benefits

Country	Impact
<i>Solid waste management</i>	
AFRICA	
Sudan	Approximately 27% of all garbage in Khartoum is consumed by urban animals such as goats, sheep and cattle. These animals also provide a valuable source of income and nutrition for poorer families.
ASIA	
China	In Guangzhou, nine crops are produced each year in open sites using night soil and urban compost.
India	In Calcutta, 800 hectares of mature dump land produce an average of 150 to 300 tons of vegetables a day without the use of chemical fertilizers.
<i>Wastewater management</i>	
AFRICA	
Tunisia	In Tunis, 1,750 hectares (mostly forage) are irrigated with treated wastewater.
ASIA	
China	In Shanghai, 8,000 tons of night soil and seepage are collected each day (about 90% of the city's human waste). After treatment, the waste is sold to farmers in the urban region.
India	The 3,000 hectares of Calcutta's sewage-fed lagoons produce an average of 6,000 tons of fish a year.
NORTH AMERICA	
United States	Two hundred wastewater reclamation plants throughout the state of California save 759,000 cubic metres of fresh water each day, with most of the treated effluent put into agricultural use.

Source: Compiled by The Urban Agriculture Network from various sources.

Farmers prefer wastewater because of the nutrients it provides to the soil. Use of wastewater for irrigation is a traditional practice in Tunisia and is now an official practice. In 1988, 26 treatment plants served 1,750 hectares of land. Future projects will extend this to 6,700 hectares using up to 95% of the treated wastewater, most of it in the Tunis region.²⁶

A very promising use of urban farming is biological treatment of sewage ponds and wastewater-contaminated lakes with aquatic plants such as duckweed and water hyacinth (see case 5.1). These crops purify the water and are commercially useful as high-protein animal and fish feed. This technology is being used with profitable results in Bangladesh, India, Mexico and the United States.

Despite these examples, relatively few cities in the world have waste management systems that are organized to comprehensively reuse waste, let alone process it as an input for farming. Most recycling, including use of waste in farming, is done in the informal sector (case 7.7). Unregulated waste management, especially by individuals, has its dangers, as discussed in chapter 8. However, managed at the community level, waste recycling and composting can improve the waste management system and increase the service in more parts of the city, while reducing or avoiding municipal costs. This is being demonstrated through research in Indonesia by the Harvard Institute for International Development.²⁷

Case 7.7 Growing vegetables on garbage dumps in East Calcutta

Calcutta, India, has some of the most outstanding waste-into-farming systems in the world (case 3.5 describes the wastewater-based fisheries). At Calcutta's main garbage dumping site, the Municipal Corporation leases about 800 hectares of older dump plots with rich compost for intensive farming. Small farmers and cooperatives produce 150 to 300 tons a day of up to 25 varieties of vegetables, which fetch high prices in Calcutta. The intensive farming generates employment for about 20,000 youths and men and women.

The site consists of fingers of solid land jutting into a series of lagoons east of the city. The fields are served by unpaved roads. Farmers provide their own security by rotating night-watch duty. The farming system is labour-intensive, including hand-carried irrigation water.

Inorganic materials are removed from the garbage by an informal recycling industry before the waste gets to the dump site. The remaining organic waste is rich in nutrients, and no chemical inputs are needed or used. This traditional farming produces safe food and is environmentally sustainable.

Sale of the produce is to middlemen at the farm gate and direct sale at city centre markets. Rent is paid to *thika tenants*, or landlords, who lease large tracts from the Calcutta Municipal Council. The West Bengal State Department of Agriculture provides monitoring and tests for food safety.

Contact: Christine Furedy, Urban Studies Programme, York University, Toronto, Canada.

Conservation of resources

The relationship between urban agriculture and resources is multifaceted. The potential role of urban farming in transforming urban waste into useful agricultural inputs and in making productive use of otherwise idle land has been discussed. This chapter has also shown how human resources (human energy, availability, knowledge and skills) and economic resources (especially through the fun-

gibility of income that is tapped for other basic needs) can be used productively.

Urban farming assists the conservation of bioregions and their resources by reducing the pressures to convert deserts, mountain slopes and rainforests into cropland and to cut woodlands for fuel wood. Because urban agriculture methods are intensive, products are produced on a fraction of the land needed for rural production. Urban agriculture is also parsimonious in its use of water. Thus both land and water are conserved.

Urban agriculture can contribute to resource conservation in yet another important way. It helps to conserve energy by reducing the need for transportation and cooling.²⁸ The average pound of food in a supermarket in the United States travels an estimated 2,000 kilometres (1,300 miles) between its point of production and its point of consumption.²⁹ This average distance is cut significantly when more food is produced locally.

In poorer countries, the distance saved with increased urban agriculture may not be as great, but the impact may be more beneficial since energy costs are higher in actual and relative terms, and the proportion of traffic that is moving food is greater. It has been estimated that in Port-au-Prince, Haiti, more than half the vehicles moving goods from the north to the city transport food.³⁰

The reduced traffic and the potential savings in energy and transportation costs from increased local production are obvious. Not so

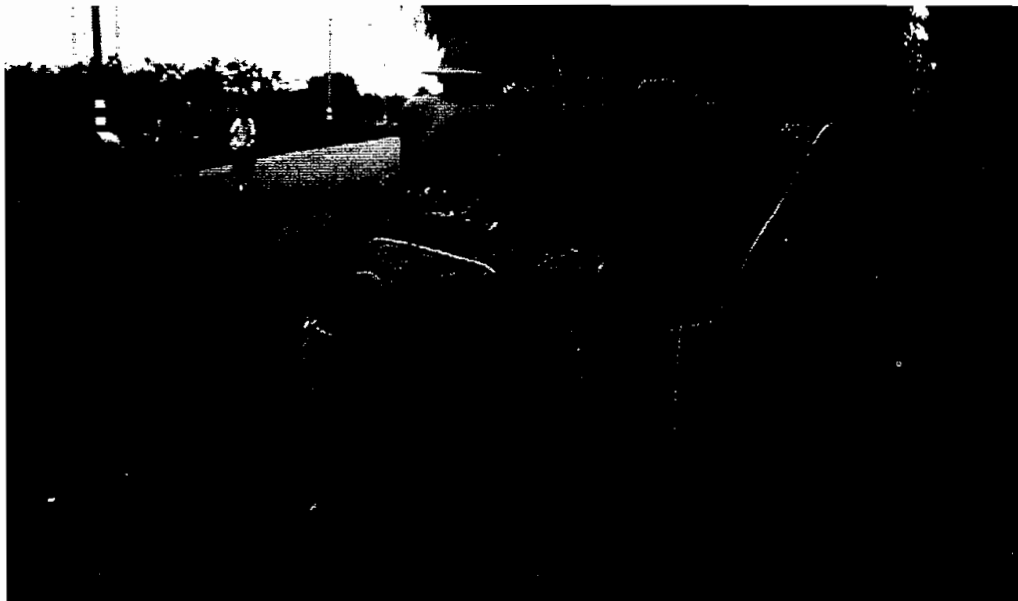


Photo 7.13 Animal-powered cart bringing produce into Beijing

obvious are the savings in storage (including cold storage) and in product lost due to handling and transport.

Urban production of fuel wood (for example, eucalyptus) can substitute for other, imported sources of energy or for fuel wood grown in more distant sources; in the process, it may help reduce agriculture's expansion into rainforests, deserts and other fragile ecosystems, while also cleaning the urban air. Crop residues are used for energy. Animal dung is commonly used as fuel in cities in India and elsewhere.

Urban crops need less packaging because they travel for less time and over shorter distances. Even with less package protection, there is less loss due to handling and deterioration. Particularly in tropical climates, these conservation advantages are considerable.

Finally, urban agriculture transforms waste into food and thereby conserves petroleum (used to produce nitrogen fertilizer) and the world's phosphate and potash reserves.

Disaster mitigation

Of all of urban agriculture's potential benefits, its contribution to disaster mitigation is perhaps the least appreciated and least understood benefit. Urban agriculture makes two principal contributions to disaster mitigation: it makes productive use of hazard-prone and sensitive areas, and it mitigates civil and economic crises.

Productive use of hazard-prone and sensitive areas

Urban agriculture offers a productive use of urban areas that pose a high risk of natural disaster and that are expensive to build on, such as steep slopes and floodplains. Tree orchards and marketable grasses such as vetiver are excellent for reducing erosion and vulnerability to disasters in sensitive areas like wetlands, steep slopes, unstable soils and floodplains (case 7.8). Trees and grasses are particularly effective in holding steep slopes. Terraced crops are among the best ways to use such slopes. Managed forestry can supply the fuel and wood demands of the city.

Case 7.8 Cultivating vetiver for environmental and disaster control

Soil erosion on deforested hills, along waterways and in conjunction with public works is a major problem in urban areas. It makes the land vulnerable to floods and winds and reduces the amount of available farm land.

Vetiver is a thick, tough grass that can withstand even tropical storms. The dense grass forms a wall against soil erosion and creates farmable terraces on hill-sides. The tough plant has roots six to ten feet deep and coarse blades that rise equally high above the ground. The thick growth prevents water runoff, forcing the water to soak into the soil, making the land farmable and raising the water level of aquifers. Planted across a floodplain, vetiver can slow the force of floods and protect field crops. In Fiji, vetiver planted on a sugarcane plantation survived a storm that rained 20 inches in three hours.

Vetiver thrives in the tropics but can grow in any type of climate, humidity and soil. It does not spread uncontrollably because it does not have runners or rhizomes and its seeds are usually sterile. Thus its growth and spread are easily managed:

Vetiver can be planted along public works—railroads, roads, steel structures—to prevent damage from washouts. It can be planted along the sides of canals, bridges and dams to prevent scouring. Vetiver also has commercial uses. It can be used for mulch, in animal pens, and to make ropes, hats, thatching, mats and other woven items.

Contact: See source listed in appendix C.

Floodplains offer the opportunity to plant crops that need irrigation. In both fluvial and coastal plains, crops can be protected from floods by trees and grasses, with the latter feeding poultry and livestock.

Urban agriculture is also a productive land use for hazardous areas such as airport landing approaches, utility rights-of-ways, highway shoulders, industrial zone peripheries and solid waste dumps. After closure, sanitary landfills and dumps require years to settle and be safe for residential or other uses. During these years, agriculture is an economic use.

Many cities suffer from polluted groundwater sources. Urban agriculture is an appropriate use on permeable soils over shallow aquifers (as long as no chemical fertilizers or pesticides are used). The same is true for unstable soils such as expanding clays. A well-known example is the downtown area of Managua, Nicaragua, which was hit by a severe earthquake in 1972. Because this area is highly susceptible to future disasters, it was not resettled and instead was put into agroforestry and open space uses.

Mitigation of civil and economic crises

Manmade disasters can also be mitigated through urban agriculture. Urban agriculture can be a basic source of nutrition in refugee camps, besieged cities or cities otherwise cut off from their food supply due

to civil strife. Although grain and cooking oil are generally provided by relief agencies, fresh meat and vegetables are always in demand and can be produced by the refugees themselves. Urban farming can contribute to survival in long-term war situations as well as in the aftermath of war devastations.

As noted earlier, urban agriculture is counter-cyclical to economic trends, flourishing in times of recession or depression and expanding as unemployment grows. Urban agriculture offers food security in times of economic and civil crisis by improving physical access to food and contributing to an informal economy. Urban agriculture's capacity to respond to the disaster of war was well documented in European cities during the Second World War. A similar capacity persists today. Kinshasa, Moscow, Baghdad and Beirut survived crises during the 1980s and early 1990s by quickly turning to urban agriculture (case 7.9).

When the economy and civil order collapsed in Zaire starting in the late 1980s, the largest city, Kinshasa, already had an urban agriculture farmers association of some 6,000 members.³¹ Farming activity in the city expanded to reduce starvation.³² And in Kampala, Uganda, residents planted the verges of streets and vacant lots to feed themselves and their neighbours during the Idi Amin era and the civil war. To date, there have been no positive government interventions in Uganda, but there has been some NGO support, including from the YWCA. Food production has persisted in times of peace, and the municipal administration is considering including urban agriculture in the new city plan. Makerere University has been studying the process, with some future possibility of influencing national policy.³³



Photo 7.14 Greenhouses within the “green belt” of Beirut

Case 7.9 Greenhouse farming in response to civil war in Beirut

During emergencies, farmers grow for their own families' consumption. In addition, intensive commercial production sometimes flourishes and may survive the emergency and become a viable market activity.

Lebanon was the fruit and vegetable basket of much of the Middle East until its civil war, starting in 1975, fragmented the city and broke up the distribution channels for agricultural products. Each zone had to be self-contained, including in its food supply. Consequently, more intensive horticultural methods had to be developed, and the use of greenhouses became widespread.

Dozens of greenhouses exist within the urbanized area of Beirut, most still operational. The expertise acquired in designing and constructing greenhouses has translated into a greenhouse export industry to other countries in the Middle East.

Contact: See source listed in appendix C.

During the civil war following independence in Mozambique, the socialist government initiated urban agriculture through cooperatives in the green spaces of the capital and other cities. In one case, a colonial golf course was converted to irrigated rice production.³⁴ The "green belt cooperatives" have expanded beyond food production to health care, day care and other economic and social enterprises. In 1993, the African Development Bank made a low-interest loan to support agriculture in the *zonas verdes*.



Urban farming is undertaken for different benefits by different interests. Farmers may be more interested in the nutrition and income benefits, while city administrators may be more attracted by the environmental benefits, as may be communities living in environmentally degraded areas.

The practice and benefits of urban farming can be transferred across farmers and regions. In a place where middle-income backyard gardening is well established, the best practice can be moved to low-income community gardens and to commercial market gardening. Where a large corporation is engaged in plantation vegetable production, production can be shifted to small-scale urban outgrowers. Greenhouse hydroponics can be transferred from large commercial operations to squatter area rooftops. This kind of expansion and diffusion can have a synergistic effect, expanding the number and kinds of benefits from any one activity.

Nevertheless, the benefits of urban agriculture do not come without risks and costs. The risks of injury to health and of environmen-

tal pollution are greater than those for rural agriculture for two reasons: the farming systems are more intensive, and their proximity to dense human populations makes mistakes or failures more costly. Thus systems must be designed more carefully and monitored more stringently. Substantial monitoring processes currently exist, but further development is necessary in many cities and countries.

Notes

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3. Anthony A. Churchill, *Shelter, Poverty and Basic Needs Series* (Washington, D.C.: World Bank, 1980).
4. Diana Lee-Smith and others, *Urban Food Production and the Cooking Fuel Situation in Urban Kenya: National Report—Results of a 1985 National Survey* (Nairobi: Mazingira Institute, 1987).
5. Daniel G. Maxwell, "The Impact of Urban Farming in Kampala on Household Food Security and Nutritional Status", paper presented to the first Crop Science Conference for Eastern and Southern Africa, Symposium on Women and Agriculture, Kampala, Uganda, 14–18 June 1993.
6. International Institute for Rural Reconstruction, *Annual Report: Family Food Production Program for Negros* (Silang, Cavite, Philippines: IIRR/UNICEF, 1990).
7. Florentino Solon and others, "An Evaluation of Strategies to Control Vitamin A Deficiency in the Philippines", *American Journal of Clinical Nutrition* 32 (1979): 1445–53, quoted in Daniela Soleri, David Cleveland and Timothy Frankenberger, "Gardens and Vitamin A: A Review of Recent Literature," Report no. IN-2, prepared for the US Agency for International Development, Office of Nutrition, by the University of Arizona (Arlington, Va.: Vitamin A Field Support Project, 1991).
8. Soleri, Cleveland and Frankenberger, "Gardens and Vitamin A".
9. UNICEF and Kampala City Council, "Nutritional Status of Young Children in the Poorer Parts of Kampala", 1981.
10. "Kinshasa—The Garden Spot of Africa?" telegram from the US Embassy, Kinshasa, Zaire, to the Secretary of State, Washington, D.C., 10 April 1992.
11. Dale Gilles, Peace Corps, Washington, D.C., personal communication, 1993.
12. Maarten Immink, personal communication, 1994.
13. Some recent studies confirm the important economic contributions of urban agriculture. See, for example, the studies by Mvena and others; Lee-Smith and others; Schilter, Gutman and others; and Yeung listed in appendix G.
14. Irene Tinker, introductory comments, Canadian African Studies Association Conference, Toronto, May 1993.
15. Lee-Smith and others, *Urban Food Production*; and Daniel G. Maxwell, *Land Access*

and Household Logic: Urban Farming in Kampala (Kampala, Uganda: Makerere Institute of Social Research, 1993).

16. Sustainable Cities Programme, *Dar es Salaam: Environmental Profile* (Nairobi: United Nations Centre for Human Settlements, 1992), p. 8.

17. Bishwapriya Sanyal, "Urban Agriculture: Who Cultivates and Why? A Case Study of Lusaka, Zambia", *Food and Nutrition Bulletin* 7, no. 3 (September 1985): 15–24.

18. R.E. Heimlich, ed., *Land-Use Transitions in Urbanizing Areas* (Washington, D.C.: The Farmland Foundation and USDA, 1989); see especially pp. 207–17.

19. Yue-man Yeung, *Urban Agriculture in Asia* (Paris: United Nations University, Food-Energy Nexus Programme, 1985).

20. Allison Brown, personal communication, 1993.

21. Fifty jobs per hectare were documented from hydroponics in Bogotá, and 40 jobs per hectare for raised-bed salad production in San Francisco. Jorge Zapp, personal communication, 1993; *Natural Life* (July/August 1992).

22. E.G. McPherson and others, eds., "Chicago's Urban Forest Ecosystem: Results from the Chicago Urban Forest Climate Project", General Technical Report NE-186 (Radnort, Pa.: US Department of Agriculture, Forest Service, 1994).

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Problems related to urban agriculture

The common perception in Africa and Latin America is that urban agriculture is marginal, temporary and archaic. Some regard it as an activity that is actually harmful to farmers, consumers, the environment, the urban land economy and the city's appearance.

Most concerns about urban agriculture are about potential—rather than inherent—problems (table 8.1). If not practised properly, urban agriculture can be unhygienic or polluting. Concerns therefore should not be dismissed or underestimated. The dangers of poorly practised urban farming were illustrated in Peru in 1992. Irrigation of vegetables (which are eaten raw) in peri-urban farms with untreated wastewater resulted in a few cases of cholera in Chile (figure 8.1 and case 8.1). Most potential problems can be easily averted.

However, authorities have usually responded to these problems by prohibiting the farming activity rather than trying to resolve them. In Nairobi, for example, it is illegal to grow crops above a certain height. Lusaka, Kampala and other cities once banned maize cultivation, which was believed to spread malaria. Most North American cities ban poultry production as unhygienic. Lomé, Togo, prohibits the growing of sorghum in the city because authorities think it makes the city dirty. Bamako, Mali, has prohibited straw-producing cereals since 1989 because they are believed to breed mosquitos and to serve as hiding places for criminals.¹

It is vital for supporters of urban agriculture to face these potential problems head on because they can also have the effect of reinforcing the sociocultural biases against urban agriculture (see chapter 9). The first step is to understand what these problems are, how and why they can occur and what effect they can have. Concerns that are genuine must be resolved if urban farming is to flourish. Those that

Table 8.1 Problems associated with urban agriculture

Area	Problem
Health	Intestinal infections can be caused by contaminated food. Insecticides can cause bronchial infections. Cows can cause tuberculosis. Trichinosis and swine flu can be caused by pigs. Compost attracts rats. Bad fish carries hepatitis and heavy metals. Vegetables can carry heavy metals. Insecticides on vegetables and fruit can cause stomach poisoning. Offal contaminates water, which causes diarrhea. Informal community markets often sell unmonitored cooked food. Raising livestock in the city leads to informal, unsupervised slaughtering Where urban agriculture is close to industry, hazardous toxins can be picked up in the crops.
Environment	Waste and chemicals pollute water. Insecticides can cause air pollution. Overgrazing can damage grass land. Waste and chemicals can pollute the soil. Urban agriculture sometimes replaces forest cover with field crops. Urban agriculture drains wetlands and reduces biodiversity (as do all urban land uses). Some farming practices on stream/riversides and steep slopes can contribute to flooding and erosion.
Social	Urban agriculture is often women's agriculture and places yet another burden on women. Urban agriculture engages and can overwork children.
Urban Management	Urban agriculture is difficult to tax. Urban agriculture sometimes occupies a site that can support a higher-rent use. Urban agriculture uses expensive potable water without paying for it. To be safe, urban agriculture requires more monitoring per unit of production than some other urban production processes.
Other	Urban agriculture can be unattractive, depending on how it is implemented. The safety shoulders of highways, when used by farmers, sometimes contribute to accidents.

Source: The Urban Agriculture Network.

are mere attitudinal biases and mistaken beliefs—for example, that farming is unaesthetic or that it serves as a hiding place for criminals—must be discarded.

The main problems that can result from urban farming occur because of its close proximity to densely populated areas sharing the same air, water and soil resources. Production of food in the polluted environment of cities may cause contamination. At the same time, livestock rearing and use of chemicals and waste in farming can contaminate the soil and water resources used by city residents. Although these and many other problems are shared by rural farming, the population concentration in cities makes their impact more serious. Many problems are caused by poor practice through lack of information and extension assistance.

The problems enumerated in this chapter have been voiced by researchers and policy-makers who were contacted during this study. More research is needed to establish the extent and seriousness of the problems. In fact, data on the problems caused by urban farming are even more scant than data on its benefits.

The problems caused by urban agriculture can be grouped into three categories:

- ▼ Negative health and hygiene impacts
- ▼ Negative environmental impacts
- ▼ Other minor and major effects.

Health and hygiene problems

Potential health and hygiene problems can result from a number of activities associated with urban agriculture.

Crop cultivation in polluted city environments

Pollution from industrial and commercial activity affects the soil, air and water resources that urban farming uses. This pollution in turn poses health hazards to producers, handlers and consumers.

Soils near roadways may suffer heavy metal pollution from airborne lead and cadmium from gasoline exhaust. The lead may also settle on the leaves and fruits of crops. If consumed, the crops may cause metal poisoning and intestinal problems for some people. A study in New York City in 1976 measured the lead and cadmium content in vegetables from 17 urban gardens. The study concluded that the metal content in the vegetables was not high enough to have a negative impact on healthy people. However, children, pregnant women and

adults with inadequate metabolic systems may not be able to metabolize and excrete the lead and may be under a health risk.²

Other studies in the United States indicate that green leafy vegetables like spinach are the most vulnerable to heavy metal pollution, and root crops and fruit trees are the most resistant. One expert recommends that green leafy vegetables should be planted a minimum distance of 7.5 metres from roads where leaded gasoline is used.³ Another solution to the problem of heavy metal content in soil is to add one part organic matter to three parts of contaminated soil to lower the pH (acidity) level. If the pH level of soil is maintained above 7.5, lead uptake by the plant is prevented and cadmium uptake reduced.

For crops that are cultivated near roads, lead can be removed from the surface of a vegetable, fruit or root crop by washing with diluted vinegar or dishwashing liquid and by peeling before consumption. In addition, planting more resistant crops, such as fruit trees or cassava, by the roadside can act as a hedge and protect more vulnerable crops from exhaust fumes.

Where soils are contaminated with metals or chemicals, crops can be planted in media brought from outside the affected area. This practice is particularly feasible with techniques such as shallow-bed gardening, container farming and hydroponics (see cases 5.4 and 5.5). Where fish and other seafood are contaminated by toxins in urban waters, the water can be treated biologically (see case 5.1).

Use of chemicals in urban farming

Excessive use of insecticides, fertilizers and other chemicals in farming deposits chemical residues in crops. These residues are harmful to human health, causing, among other health problems, cancer, respiratory diseases, sterility, contamination of mothers' milk and a variety of intestinal diseases. The impact on human health occurs through either direct contact or eating food that contains chemical residues.

In crowded city areas, chemicals released into the atmosphere through spraying are likely to affect large numbers of people. It is therefore even more important to regulate the use of chemicals in urban farming than in rural farming, as well as to train farmers in the most appropriate application methods. This problem must be addressed at the national level. However, monitoring systems that

do not cover informal markets will be unable to stem the sale of contaminated food by small-scale urban farmers through informal marketing channels.

Use of inappropriate insecticides and fungicides is somewhat more likely in urban than rural situations because of broader availability in urban settings. For instance, fumigants or insecticides packaged for commercial or industrial use may get into the hands of uneducated urban farmers and then be used on edible plants or crops.

Use of domestic waste in urban farming

Reusing waste in farming has many positive benefits. Composted organic solid waste, as well as treated household sewage, contains nutrients that are beneficial to crops and have always been used by farmers. However, unregulated urban farming leads to discretionary treatment and use of waste by farmers. When city farmers use uncomposted solid waste to fortify soils or untreated wastewater to irrigate crops or feed livestock, food contamination is a serious concern. Outbreaks of illness caused by contaminated food, such as the cholera epidemic in Latin America in the early 1990s, have heightened these concerns (case 8.1).

Case 8.1 Cholera outbreak in Santiago caused by the use of raw sewage in urban agriculture

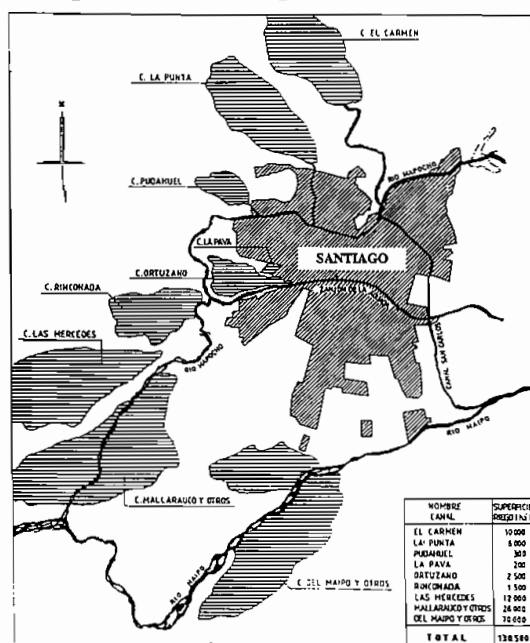
Cholera returned to South America in the early 1990s, appearing first in Santiago, Chile, in 1992. Investigations found that tainted vegetables, grown in metropolitan Santiago using irrigation water polluted by raw sewage, were partly to blame.

Although Chile had enacted laws regulating sewage irrigation in 1941, they were not enforced. Following the outbreak, the government bulldozed thousands of hectares of vegetable crops and since then has prevented such crops from being planted where they will be irrigated with wastewater.

Santiago had suffered for decades from typhoid outbreaks. Rapid growth of squatter communities, combined with a rise in economic and consumption levels, had led to an increase in effluent in streams, without a comparable increase in treatment. The government's actions to stem the cholera outbreak also rid the country of typhoid. Although the supply of vegetables dropped the first year after the government action, it recovered once horticultural zones were relocated to lands that could be irrigated safely. Confidence that the vegetables no longer posed a health risk contributed to a doubling of their prices. Prices have stayed at the elevated level, denying the benefits of fresh vegetables to a large share of the low-income population.

The cholera-control measures have had far-reaching consequences. Greater Santiago is one of the most fertile regions of the country, providing 40% of Chile's

Figure 8.1 Areas irrigated with wastewater and producing contaminated vegetables, Santiago, Chile, 1990



Source: Carl Bartone, World Bank, presentation at workshop, May 1995; "Chile: Managing Environmental Problems: Economic Analysis of Selected Issues", Report 13061-CH (Washington, D.C.: Environment and Urban Development Division, World Bank, December 1994).

Contact: Carl Bartone, World Bank, Washington, D.C. (see appendix F for complete address).

agricultural exports and a tenth of its total exports. The handling of sewage-based irrigation therefore has national economic repercussions—which explains why the government reacted swiftly and why it is now seeking a more enduring solution to the problem. Studies are now under way with World Bank support. The solutions that have been considered to date are costly—US\$750 million for wastewater treatment, an annual cost per capita of \$7.00 to \$7.50 a year.

There is a significant lesson to be learned: enforcement of existing regulations could have prevented the outbreak. But because there are a dozen regulatory agencies, coordination of monitoring and enforcement is difficult. A new partnership among farmers associations, non-governmental organizations, local government and the national government may be the key to solving the problem. Potential solutions include improved irrigation methods, regulation of crops (rather than prohibition), cost recovery from the farmers who benefit as well as from residents, modified food preparation and institutional reform.

Some city waste contains toxins, chemicals and inorganic matter that is hazardous to human health if transmitted through food. The waste of smaller cities and towns in developing countries is less likely to contain chemicals and toxic materials than the waste of larger cities.

One-third or more of the vegetables consumed in Asmara, Eritrea, are irrigated with wastewater.⁴ In Yaounde, irrigation water for salad plants often contains rubbish and sump oil or sewage.⁵ Squatters in Lusaka irrigate their crops with wastewater illegally channelled from a neighbouring sewage lagoon.

Reuse of solid waste in farming requires separating waste and treating it at the community level for reuse—which current, centralized waste management systems in most developing-country cities are not designed to do. If not properly managed, composted solid waste can attract rats.

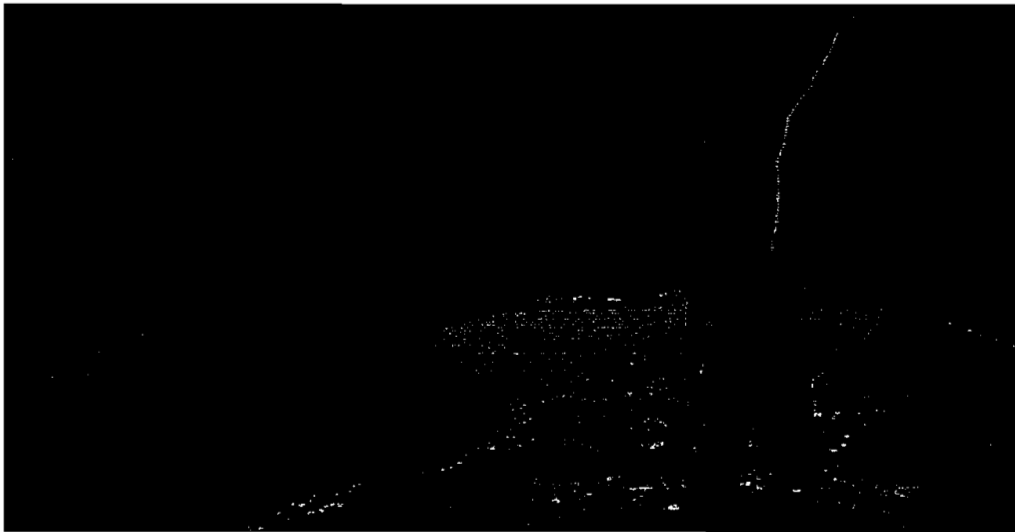


Photo 8.1 Young farmer applying untreated sewage on leafy vegetables in Pikine, Dakar

Wastewater can be treated biologically by using an intermediate plant or animal, such as algae or duckweed, as organic fertilizer or animal feed.⁶ A second approach to managing the problem of pathogens in wastewater is to grow crops that are less susceptible to contamination. Some plants and animals absorb, retain and transmit pathogens more readily than others; peelable fruit at the end of a branch transmits less pathogens than a leaf crop like lettuce, for example. Crops that are used as feed for livestock are an extra step removed from human consumption and therefore usually present fewer health risks.⁷

Many cities use wastewater only to grow non-food crops, including livestock forage, forest crops for fuel and construction and ornamental horticulture. Australia and Mexico, for example, limit the use of wastewater to irrigating crops not intended for direct human consumption. In Zimbabwe, sewage water is used to irrigate cattle pastures—which are run by municipal authorities that make millions of dollars in profits through cattle sales.⁸

Fish grown in wastewater, or in surface water bodies contaminated by waste, may also be contaminated and carry diseases such as hepatitis. An outbreak of hepatitis in Shanghai in the 1980s was linked to consumption of coastal water shellfish. Coastal waters also require management and biological treatment.

Research on the safety of using waste for food production has been conducted by several institutions, including the World Health Organization, the Food and Agriculture Organization, the World Bank, the US Environmental Protection Agency and the Asian Insti-

tute of Technology. These institutions have found the use of waste to be beneficial for farming as well as resource conserving. Appropriate guidelines for use and standards for treatment have been created by some, including the World Health Organization and the US Environmental Protection Agency.⁹

To reduce the risk of contamination, there is a need to research and create local waste recycling and reuse programs, institute treatment and application standards and establish public-private partnerships to ensure adherence to standards.

Rearing livestock in cities

Keeping livestock in the city is criticized as creating health and environmental hazards—making neighbourhoods unhealthy through offal, odors and noise and clogging the sewerage system. Grazing herds are feared to create traffic problems.

Animal refuse can carry germs that can cause diseases. In the late 1980s, doctors in Dar es Salaam became convinced that dung rotting on city roads was contributing to the spread of tetanus. Seventy-two percent of livestock keepers in that city leave dung along roadsides for collection by horticulturists, 12% dispose of it in city dump trucks and 16% dispose of it using their own vehicles.¹⁰ Many other cities manage their livestock more responsibly; properly handled animal



Photo 8.2 Animals roaming in fields outside Asmara, Eritrea, polluting them with uncomposted feces. The fields are irrigated with untreated sewage.

refuse is valuable as manure to fertilize soils and fish ponds. In India, for example, cow dung is dried for use as fuel and to sanitize the walls and floors of houses.

Animal rearing in the city can also lead to an increase in tuberculosis, leptospirosis, anthrax salmonellosis and brucellosis—all transmitted through milk and meat. Cattle and buffalo rearing in cities in South Asia carries the risk of transmitting bovine tuberculosis to humans.¹¹

Livestock farmers often ignore animal diseases. Because the testing infrastructure is typically inadequate and the cost of animal treatment high, animals are usually not tested for diseases. Farmers can fairly easily evade the public health system.¹² For instance, in urban Nepal, where sewage systems are poorly developed and sewage flows freely, pigs and cattle eat human waste.¹³

Environmental problems

The high population density of urban areas results in more intensive use of resources such as land and water than in rural areas; thus problems caused by chemical contamination have even more serious implications. Heavy use of chemical inputs by the farming sector can pollute the soils and the water table with nitrates and heavy metals. Insecticides are greatly overused in Bamako, Mali,¹⁴ and in Kisangani, Zaire, where chemical fertilizer is subsidized by the government.¹⁵ Agricultural runoff washed down by the rivers is killing the plant and animal life of coastal bays near Rio de Janeiro and Washington D.C. Spraying insecticide also pollutes the air.

A number of biologically based practices, including “organic”, “regenerative” and “biointensive” agriculture, are less damaging to the environment. Supplying compost and treated sewage to farmers is essential to reducing the amount of chemical fertilizer needed. Integrated pest management and multicropping practices can substitute for insecticides.

Leaching of solid and liquid waste from intensive livestock farms into the soil is a major environmental problem in urban as well as rural areas. In Holland, Thailand and the United States, surface and groundwater contamination from intensive, large-scale poultry and shrimp production were reported during the 1980s. Costly mitigation programmes were put in place and controls placed on farmers

in some peri-urban situations. Singapore temporarily prohibited intensive livestock farming in the 1970s. Both Taiwan (province of China) and the Netherlands imposed new restrictions in the 1980s as a result of environmental degradation caused by pig rearing.

Leaching can be prevented through the proper treatment and reuse of animal waste as fertilizer. In Malaysia, UNDP and the Food and Agriculture Organization are researching technologies for treating pig waste. Some farmers are growing worms to treat pig effluent lagoons for conversion to fish feed.¹⁶ However, intensive use of animal wastes on soils can cause nitrate pollution in as short a period as five years.¹⁷ It is therefore critical to monitor and regulate the use of manure and other organic waste as well as chemicals in urban farming.

Overgrazing and destruction of plantation areas by animals can lead to increased erosion. Loose animals also cause traffic problems and result in accidents in congested cities. In 1985, 12 of 2,868 road accidents in Dar es Salaam were caused by roving animals; in 1989, animals caused 176 of 3,586 accidents—a tenfold increase in four years.¹⁸ Zero-grazing, practised in cities such as Cairo that prohibit livestock movements, is one possible solution to overgrazing, rotting dung in streets and traffic congestion.

Animal-related pollution can be reduced through changes in rearing practices, for example, discouraging intensive rearing of a single species in one area. There is also a need to institute proper animal waste management practices to close the nutrient loop (see chapter 1). Improving land and water tenure security and creating a legal system that



Photo 8.3 Goats grazing on park land in Oyster Bay, Dar es Salaam

makes farmers responsible for the land they farm will result in better farming, soil and water management practices.

Agriculture in the city can have a negative impact on the green space and on biodiversity if it replaces forested land, wetlands or other biologically rich natural environments. Overgrazing by livestock can also destroy grasslands. Farming along river and stream-sides can lead to increased erosion and silting in the river if care is not taken by farmers.

Intensive livestock farming can also lead to odor and noise pollution. In a survey in Dar es Salaam, about 80% of respondents reported bad odor from urban livestock as a problem, and two-thirds reported noise as a problem.¹⁹ There may, however, be a double standard inherent in some of these opinions. Odors and noise caused by livestock often are no worse than that caused by some other urban activities, such as manufacturing and vehicular traffic.

Other problems

There are a number of other potential problems, some more important than others (see table 8.1). Two of these are deserving of discussion here: the inefficient use of resources by urban farming and the eyesore created by some urban farming.

Inefficient use of resources

A significant percentage of urban farming activity is conducted informally or illegally. Farmers simply expand onto unused public or private land or work out an informal agreement with the owner, taking over land planned or set aside for other purposes (such as forested areas) or encroaching on land that should be conserved for environmental reasons (such as wetlands). Where the use of land is not regulated and an economic rent is not paid, urban farming may be an economically or environmentally inefficient use.

The same is true of the use of water by farmers for irrigation. If farmers are not charged a fee, they may use water designated for other purposes or follow inefficient irrigation practices. Some urban farmers divert water from the municipal potable water supply, which can create water shortages in the city. Overuse of surface or groundwater can also reduce the city water supply. The Savanna Bogotá,

Colombia, is experiencing a water crisis due to heavy pumping of groundwater to irrigate export flower crops. This crisis can be mitigated by reuse of Bogotá's wastewater for irrigation.²⁰

Regulation and pricing of land and water for farming use ensures that these scarce resources are used efficiently and allocated optimally. However, charges for land and water may drive some poorer, less efficient farmers from the market. A system of subsidized land and water allocation may be needed to enable poor farmers who are growing food for family food security to continue farming.

Aesthetic impacts

The image of a cattle corral, pigs at a town dump, poorly tended vegetable patches in a community park or chickens in a front yard is offensive to many sensibilities. The production of food and fuel tends to be more visible than many other urban production activities, such as making furniture or bread, which take place in buildings. Because urban agriculture is more exposed to public view, it may be appropriate to place it under greater control and to measure each urban agriculture activity not only for its health and environmental impacts, but also for its aesthetic impact.

Agriculture in the city need not be ugly if it is well managed and in appropriate places. Sweet potato growing on the roadside, fruit trees in the park, sheep grazing on a hillside and fish in a pond may be acceptable images. But if urban agriculture is unregulated and temporary, it is less likely to be neatly maintained.²¹



Urban farming is illegal in most cities in Africa and Latin America. Where it exists in spite of the law, it is unregulated and its safety therefore not ensured. Banning urban agriculture outright is not an effective solution to potential problems—whether real or imagined. If health, environmental, and other problems are to be prevented, urban agricultural activity must be legalized and the institutional capacity to regulate it created or reinvented. As a first step, cities need to undertake the research and cost-benefit analyses necessary to decide which types of urban agriculture are appropriate in which parts of the city.

Notes

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18. Mosha, "Urban Farming Practices".
19. Mosha, "Urban Farming Practices".
20. Kari Kiepi, Inter-American Development Bank (IDB), reported at a workshop on urban agriculture co-sponsored by the IDB and the World Bank, Washington, D.C., 26 June 1995.
21. Slides are available from The Urban Agriculture Network's extensive collection of slides from 30 countries showing attractive as well as unsightly examples of urban agriculture.

Constraints on urban agriculture

Urban farming is an economically viable industry whose development is constrained by a variety of negative attitudes and obstacles. If these constraints can be removed and attitudes changed, urban farming will become more competitive and efficient and will add dramatically to the hundreds of millions of residents whom it already serves worldwide.

The constraints on urban farming are of five broad types:

- ▼ Sociocultural biases and institutional constraints
- ▼ Constraints on access to resources, inputs and services
- ▼ Special risks of farming in the city
- ▼ Postproduction constraints, particularly in processing and marketing
- ▼ Organizational constraints.

Sociocultural biases and institutional constraints

The sociocultural biases against urban agriculture are often strong. Some arise from outdated, European “city beautiful” views of what a city should be; some are related to local cultures. They often pertain to views about aesthetics, efficiency, hygiene and modernity in general.

The biases tend to be persistent, particularly when they become institutionalized through policies, laws, regulations and enforcement mechanisms. Negative attitudes of critical actors are particularly constricting. For instance, when planners and economists regard urban agriculture as a marginal, informal-sector activity, the bias spreads to the market and credit agents, to legislators and to the general population. The result is insufficient official support and private financing and policies and legislation inimical to farming in cities.

The “modern” view of cities

In the dominant “modern” culture, rural areas have become inseparably linked with agriculture and urban areas with commerce. Agriculture thus has come to be perceived in many cultures as rural, not modern, having low productivity and yielding low returns, and at best temporary in urban areas. Many leaders consider urban agriculture a step backward, and policies have emerged that have crippled the development of urban farming.

Urban agriculture has an uphill fight to overcome the view of planners and economists that agriculture is an inappropriate, misplaced use of land in the urban economy and landscape; the belief of sanitary engineers and doctors that it is “unclean” and a health threat to the population; and the attitude of the upper-income elite that it is unsophisticated and contrary to the “city beautiful, clean and efficient” ideal.

In countries with a colonial history, a major contributor to this bias is the 19th-century European concept of the city as a planned, “civilized” space where the modern industrial revolution took root. This concept survives in the minds of many decision-makers despite decades of decolonization. This view holds that the city has space only for recreational gardens, forests and neat lawn patches—and none for growing food (except perhaps for “recreational” kitchen gardens); the use of urban waste for soil enrichment is regarded as unhygienic, and the function of the sanitation system is seen as being to get waste out of the city—and out of sight.

The visits made as a part of this study revealed that positive attitudes towards urban farming are emerging within the economically and politically influential sections of some cities. In Dar es Salaam, for example, attitudes towards livestock in the city changed considerably when the richer residents of Oyster Bay started to raise cows in their backyards (see case 5.7).

“Traditional” sociocultural biases

Social biases further limit the growth prospects of the industry. In many places, urban farming is treated as an “outcast” industry, much as tanning leather is viewed in Hindu societies and gambling in Moslem ones. This view lowers the social position of urban farmers and increases the likelihood that they will move to other occupations when feasible.

In these situations, either immigrants or a long-established group tend to dominate all of urban agriculture or certain farming systems within it, and the industry remains marginal to the society and often to the economy as well. Traditional methods, which may be inefficient, unresponsive to the changing market or even damaging to the environment, persist.

Often, immigrants who arrive with a new agricultural technology, and who may face isolation or even social ostracism as new arrivals, either choose not to share their methods or are not in communication with other urban farmers. The production of those products then becomes socially assigned to that group.

Acceptance of urban farming as a legitimate activity is also hampered by a gender bias that does not recognize household work done by women as economic activity. Although a large portion of the farming for home and neighbourhood consumption is done by women, this activity is usually not incorporated in official food or economic statistics. Nor is it always recognized fully by the household, especially the male head, as a valuable economic activity—even though it feeds the family and frees income for other expenditures.

The view that urban agriculture is “women’s agriculture” prevents it from receiving adequate research and extension services. A recent study in Sub-Saharan Africa found that although women make up 60–80% of the agricultural labour force, they receive only 4–6% of extension visits.¹ This may not be the case in all African cities, but a significant anti-female bias nonetheless does exist.

Women engaged in urban farming also have unequal access to markets, inputs, land and credit. In many cultures, women are prohibited from owning land, sometimes even from leasing it. Or women may be excluded from participation in farming for commercial purposes.² For example, in the urban farming activities at Mont Nga-fulla, Zaire, primarily women work in the home gardens for extended family consumption; men work in fisheries and tree orchards—whose products are sold in the market (see case 4.5).

Institutional constraints

Planning and cultural attitudes and the colonial heritage have resulted in policy, administrative and legal hurdles for urban agriculture in most low-income countries. Typically, urban agriculture is not included in the planning process. In a number of countries, the official attitude

towards urban agriculture is even less supportive: policies deter it, and laws and regulations limit or prohibit it.³ In colonial times, farming and animal husbandry in urban areas were prohibited in most Sub-Saharan countries. These *laws* and *regulations* continue unchanged in most countries even today, with many farmers facing harassment from government authorities as well as landowners. In Nairobi following the Second World War, the government passed a law ordering the cutting down of all crops. Livestock and horticulture remain illegal today, and although crop slashing is less common, it remains a threat.⁴ In Kampala, more than one-fourth of farmers face harassment and eviction or threat of eviction from the city council or landowners.⁵

Even where urban farming is allowed, there seldom are coherent *policies* for its development or for greater extraction of its benefits. Few countries take a planned, promotional approach to urban agriculture, although Argentina, Peru, Mozambique and Indonesia are making efforts to support farming in cities. Government policy in Lusaka, Zambia, has gone through an interesting evolution (case 9.1).

Only a handful of cities include urban farming in the land use planning and design process. In India, it is not part of the master plan of any city.⁶ Some countries (China, Japan and Indonesia) have historically included agriculture as an urban land use, and others (Brazil and Mexico) have begun to do so more recently.

The lack of positive government recognition impacts urban farming in many ways. Because no data are collected on urban agriculture and the activity has no identity or validation as a productive sector of the economy, credit agencies, research and development agencies and market agents generally view urban agriculture as a high-risk activity. The lack of government recognition also reduces the availability of land, water and waste resources.

Because the agriculture, food, health, nutrition and environmental policies of most countries do not include urban agriculture, the sector's full benefits are not available to urban populations seeking nourishment. The lack of official recognition also leads to insecurity among farmers and consequently limits their commitment to and investment in farming.

Urban farmers would like government to take an active, positive role in promoting their industry. They believe that government can help them expand and modernize their farming activities by facilitating credit, easing access to tools and seeds, paying agricultural extension agents and improving access to land for agricultural use.⁷

Case 9.1 Influence of government policy on the development of urban agriculture in Lusaka

For decades, authorities in Lusaka, Zambia, adopted negative attitudes and policies towards urban farming. Cultivation within the vast open spaces of the “garden city” of Lusaka began with the influx of migrants after independence in 1963. The city council considered crop production in the city a health hazard and enforced laws making farming of vacant land illegal. Legal proceedings were rarely taken against farmers, but authorities regularly slashed crops on public land.

With a worsening economy in the late 1970s, the urban poor felt an increased need to produce their own food. Concerned about the need to improve economic conditions, the president in a speech in 1977 urged urban residents to grow their own food, in part so that rural crops could be exported to neighbouring countries to increase foreign earnings. The president’s endorsement prompted the Lusaka City Council to stop enforcing laws against farming. Subsidized seeds for fruits and vegetables were made available through government-run stores.

Programmes promoting urban farming in low-income communities were started through cooperation among the city council, the national government, the American Friends Service Committee and later UNICEF. The programmes provided technical assistance and low-cost inputs to farmers in low-income townships; the assistance was for home gardens, rainy-season gardens farther from their homes and community gardens. One community planted fruit trees. In three squatter areas, land tenure and access to water were provided, which improved the farming activity considerably and extended the season.

In 1977, 43% of Chawama, one of the largest slums in Lusaka, was farming home gardens, and 53% of the families were farming rainy-season gardens. On average, residents were substituting 10–15% of their food expenditures by growing their own food. A decade later, a survey of low-income areas found that 40% of the families had plot gardens, 25% had rainy-season gardens and 19% had both.

Contact: Carole Rakodi, University of Wales, Wales, United Kingdom (see appendix for full address).

Constraints on access to resources

Most cities have sufficient usable land and water (surface water and wastewater) to allow farming, although both are scarce urban resources. Yet in most cities, farming is not recognized as a land use or as a legal consumer of water, creating an administrative hurdle.

The main land and water issues affecting urban agriculture are the use of waste and drainage water for fertilizer and irrigation and competition with other urban uses. Public authorities have crucial roles with regard to both issues. They organize and control access to appropriately sanitized wastewater and influence the allocation and use of the most appropriate land for food and fuel production.

Irrigation

Although the water supply system in most cities does not recognize farming as a customer, this is not a real issue because irrigating with potable city water is a wasteful use of this resource. The irrigation water that urban farming needs can usually be supplied from wastewater, groundwater and surface water. (Using wastewater to irrigate also provides nutrients to crops.) Farming therefore need not compete with household usage or with drinking water.

The constraint that urban farming faces is access to groundwater, sewage water and surface water. Where surface water and wastewater are available for farming, for example, in Singapore, urban agriculture flourishes. However, wastewater is usually not readily available to urban farmers because sewage systems are designed to remove sewage from the city, not to reuse it locally. Nor do cities typically make provisions for reuse of surface water in farming. There are no local treatment facilities or standards and monitoring systems to ensure the purity of wastewater (control of chemicals, toxic materials, pathogens and vectors in the water) before it is applied to land crops or used as a growth medium for water crops and fish. The lack of access to alternative irrigation water compels urban farmers in many countries to use piped water supply, often illegally.



Photo 9.1 Sewage-based experimental aquaculture pond at the Asian Institute of Technology, Bangkok

The presence of chemicals and pathogens in wastewater presents serious problems for urban farmers (see chapter 8). It is not, however, the only factor that determines whether wastewater can be reused successfully. Other factors include:

- ▼ Cultural acceptability
- ▼ The relative scarcity, reliability and cost of water
- ▼ The wastewater system in place
- ▼ The condition of the environment
- ▼ The health of the population.

The scale of wastewater management systems is thus one technically and politically significant factor. Economies of scale have formed the guiding principle of wastewater systems since Roman times, and especially since the middle of the 19th century. Yet smaller systems—such as biological treatment using duckweed (see case 5.1)—may be better suited to modern biological technology.

The most subtle and challenging hurdle in the use of urban wastewater for human food consumption may be cultural. In a number of cultures, irrigation with “soiled water” either is taboo, is considered unsafe and unhygienic or faces religious opposition. In Moslem countries, for example, there is particular reticence to use wastewater for aquaculture or for irrigating crops. Given the severe water shortages in the Middle East, wastewater-based agriculture is a particularly relevant area of agricultural research and consideration, already explored and applied in countries as diverse as Kuwait and Tunisia (case 9.2). Moreover, certain types of applications, such as irrigating agroforestry, are acceptable from a religious standpoint.

Case 9.2 Using treated wastewater for irrigation in Tunisia

Using wastewater for irrigation has long been a traditional practice in Tunisia and is now an official practice. In 1988, 26 treatment plants (activated sludge, trickling filters, stabilization ponds and oxidation ditches) were in operation. Today, irrigation with wastewater serves 1,750 hectares of land. Future projects will extend this to 6,700 hectares using 95% of the treated wastewater, most of it in the Tunis region.

Treated wastewater is used for irrigation in the dry seasons, sometimes after mixing with groundwater. Crops irrigated include fruit trees, forage crops and cotton. The National Water Law makes it illegal to irrigate vegetables (which often are eaten uncooked) with wastewater.

The government undertook experiments to study the short- and long-term safety of using wastewater for irrigation. Overall, use of properly treated wastewater for irrigation was found to be safe; wastewater-irrigated crops also produced higher yields than those irrigated with groundwater.

The government has created a strict and integrated system to monitor the use of wastewater for irrigation. Distribution of irrigation water is supervised by a regional Department for Agriculture Development. Use of treated wastewater requires separate clearances from the ministries dealing with agriculture, public health and the environment. The frequency of physio-chemical and biological analyses is defined. Quality standards are defined in a document, crops that may be irrigated are stipulated and guidelines for ensuring the health and safety of workers and consumers are given. Crops irrigated with wastewater are tested by the Ministry of Public Health.

Contact: See source listed in appendix C.

Concern about the proper disposal (rather than reuse) of wastewater dates to the “microbe hunters” of the past century. Over time, fear of contamination by unclean water became institutionalized in law, and many governments and bureaucracies are still reluctant to consider reusing wastewater for irrigating animal fodder and certain crops for human consumption. Professional city managers and planners, concerned about public health and infrastructural efficiency, have until recently been little concerned about the efficient reuse of waste to achieve ecologically sustainable towns and cities. They have tended to act as the enforcers of cultural values rather than as creative solvers of today’s problems.

Land and water surfaces

For land and water surfaces, just as for water for irrigation, the problem is not one of physical availability but of adequate access. Both Kampala and Nairobi still have large expanses of open land that were reserved by colonial planners in the 19th century and are still not placed in productive use today. Similarly, in Port Moresby, Papua New Guinea, a significant amount of farmable land is not farmed, primarily because of existing land tenure patterns.⁸ And the successful farming programme in Barrio Matalahib in Manila ended because land tenure was not secure (case 4.10).

Today, in cities around the world, a vast amount of land is farmed that is neither officially allocated for that purpose nor reported. Informal or illegal land transactions include usufruct agreements between landowners and farmers. However, private landowners often will not lease their land for farming because of the lack of adequate laws governing tenancy and lease arrangements.⁹ Both landholders and farmers need security of access to and exploitation of a property. Since the agricultural use does not have to be permanent, landowners’ fears

ers' fears can be assuaged with the right contractual arrangements. The validity and enforceability of permits, leases and contracts determines whether such arrangements will be practicable.

Where no arrangements exist, the informality, illegality and thus the precariousness of the activity (eviction is always a possibility) are not conducive to efficient farming. With low tenure security and questionable legality, the farmer is not motivated either to follow efficient farming practice or to be concerned about the long-term condition of the land, the need to regenerate the soil or the impact of the farming activity on the environment. (Such farmers are also considered high-risk borrowers by credit agencies.)

In Kampala, middle- and low-income urban farmers identify access to land, harassment and eviction as important problems; richer farmers do not.¹⁰ Even farmers who own their land may face problems in the form of zoning laws that prevent them from farming it.

Larger private corporations and public authorities with excess space (for example, the Port Trust in Bombay and the Singapore Airport) may be more likely to lease land to farmers to make a profit because they have greater tenure security and resources than private landowners. However, government agencies that do not pay rent are less motivated to seek a return on their excess space.

Constraints on access to inputs

Access to farming inputs—such as seeds, fertilizer, pesticide, equipment, chicks and heifers, feed and medicine—is another major constraint facing urban farmers. These inputs are not readily available in cities; the markets and sales channels either are not developed and organized or are oriented towards rural farmers. Moreover, the limited supplies are of uncertain quality. For example, the available *seeds* may not produce high yields. For many poor farmers, the only source of seeds is spoiled produce in the market-place. In Kenya, some farmers receiving help from the Undugu Society are trying to produce onion crops from discarded bulbs from the market.

Equipment and *tools* are usually designed for rural agriculture and are seldom well suited to urban needs, smaller fields and more intensive production. There is a vast untapped global market for agricultural supplies and equipment appropriate for urban farming. Italy and Japan produce special equipment for small and urban farmers, but



Photo 9.2 Vermi-composting of domestic waste for use as fertilizer in Jakarta

they are the exception rather than the rule. Recognizing the need to serve urban farming clients, a national cooperative that sells inputs in rural areas of Tanzania is opening outlets in Dar es Salaam.¹¹

Hydroponics, a farming technique that is particularly appropriate in urban areas, provides an excellent example of the special inputs needed. It requires containers, water supply mechanisms, nutrient solutions, seeds and extension support particular to the technique. Therefore, the businesses and distribution channels that service farmers practising hydroponics must be adapted to its particular needs.

Fertilizer also may not be readily available to urban farmers. Because chemical fertilizers pollute the water table and can easily affect surrounding population concentrations, it is vital that their application be both limited and properly practised. The best choice for urban farmers is composted organic solid waste (case 9.3).

Unlike the case of wastewater, the foremost hurdles to wider use of solid waste in urban agriculture are organizational rather than technical, sanitary or cultural. First, the solid waste that originates in households and businesses is most often collected as a large system and transported to major dumping locations within or outside the city. This citywide process is not conducive to maximizing the utilization of solid waste in the diverse, small-scale agricultural activity or to regenerating the natural resources of the city. Second, most solid waste management systems do not separate organic and inorganic wastes or toxic and non-toxic wastes. Solid wastes disposed of through wastewater systems are

usable for farming if the sewage is biologically treated and the sludge is composted before being used to irrigate and fertilize crops.

In most urban situations, urban farmers collaborate with their neighbours to retain and reuse solid waste. Support from the municipality and from major institutions is less common because of obsolete legal obstacles, especially in the more developed countries. However, some universities and botanical gardens have good support programmes, particularly in India, the Philippines and the United States.

Case 9.3 Producing organic fertilizer from urban waste in China

Organic waste, including night soil and solid waste, has traditionally been used by Chinese farmers to fertilize soils. In several Chinese cities, the waste management systems are organized to recycle urban organic waste for use in the production of vegetables, fruit and animal and fish feed.

Waste is collected by a municipal corporation (and sometimes by the farmers in the city's vegetable-growing communes). The municipal corporation usually manages the allocation of the waste, for which the communes pay. The fermented soil is added to other organic matter to make compost or is spread directly on the soil, away from the crop. Organic waste from the city is composted in the countryside or in municipal composting plants and sold to farmers. It is also used as an input to pig and fish feed.

In Shanghai, the Bureau of Environmental Sanitation collects most of the city's human waste. Night soil and seepage from public toilets, septic tanks and dumping stations are collected and shipped out of the city daily in sealed barges. The waste is composted for ten to 30 days, with other matter such as dead plants sometimes added to it, and then sold to farmers as fertilizer. Repeated usage has proven the waste to be a safe fertilizer.

The Shanghai Resource Recovery and Utilization Company produces a range of products from the material it recycles from the city waste. The company maintains a network of 500 purchasing and processing centres throughout the ten towns of the metropolitan municipality. The process (collection, transportation and processing) is labour-intensive but efficient and profitable.

Until recently, Shanghai disposed of all its municipal waste through farming. However, the system has begun to break down since the Chinese government began to subsidize chemical fertilizers.

Contact: See source listed in appendix C.

Constraints on access to services

Urban farmers may need more support services than rural farmers because urban production has more precise requirements, such as getting product to market on time, managing intensive production, coping with poor water and air quality and producing in the off-season.

Credit

Rural and urban farmers have similar requirements for, and difficulties in obtaining, credit. However, urban farmers often have the added difficulty that potential creditors do not recognize urban agriculture as a significant industry.

As mentioned elsewhere in this chapter, the lack of recognition, tenure insecurity, dearth of data and lack of organized markets make urban farming an uncertain activity for both private and government lending agencies. Many countries that have special credit facilities for rural farmers have no government programmes to provide credit to urban farmers. In Dar es Salaam, for example, bankers consider urban farming a higher-risk investment than other urban activities and therefore encourage farmers to diversify their agricultural products.¹²

Further research is needed to determine the actual level of risk in lending to urban farmers. Lending to urban farming may, in fact, have lower risk than lending to rural farming since it takes place closer to the markets and the technologies used may be less dependent on the climate. Moreover, farming may also hold lower risk than other urban activities because the products it produces—food and wood—have a stable and substantial demand.

Urban farmers, producing in response to market demand cycles, need working capital to manage the production cycle. The absence of credit for working capital reduces farmers' capacity to absorb business shocks and survive bad times, resulting in high failure rates. The lack of credit can also contribute to low crop yields, since farmers do not have the working capital needed to plan and purchase inputs. Without capital, poorer farmers cannot upgrade farming technology or invest in higher-yield farming systems, such as poultry, fisheries, livestock and ornamental horticulture.

Credit can help farmers improve agricultural practices by financing tools and equipment to stretch the season and processing to prepare wastewater and solid waste as inputs to soil and water enrichment. Access to credit can also enable farmers to acquire season-stretching plastic domes and tunnels to expand their production potential.

In many cities, non-governmental organizations (NGOs) help increase access to credit for entrepreneurs in the informal sector, for example, by acting as intermediaries between entrepreneurs and the banking system and organizing entrepreneurs to spread the

risk and ensure collective management and responsibility. However, even these credit supply systems often fail to include low-income urban farmers.

In Kampala, access to capital was reported as a major problem by farmers in all income groups.¹³ In India, urban farmers receive credit from the agricultural lending quota of state-owned banks—usually the part of the quota not used by rural farmers. However, this credit is not likely to reach low-income urban farmers.¹⁴

Other services

Urban farmers need different technologies than rural farmers, and not all rural farming techniques can be easily transferred to the city. Yet the agricultural research, transfer and extension agencies that serve rural farmers usually do not include their urban counterparts. Moreover, relatively little investment is made in developing or promoting farming techniques that work in urban areas or in adapting rural techniques to urban areas.

Research into techniques of particular relevance to urban farmers and problems of special concern to them, as well as dissemination of that research, could come from research agencies, government agencies and international agencies. Yet in most cities none of these groups

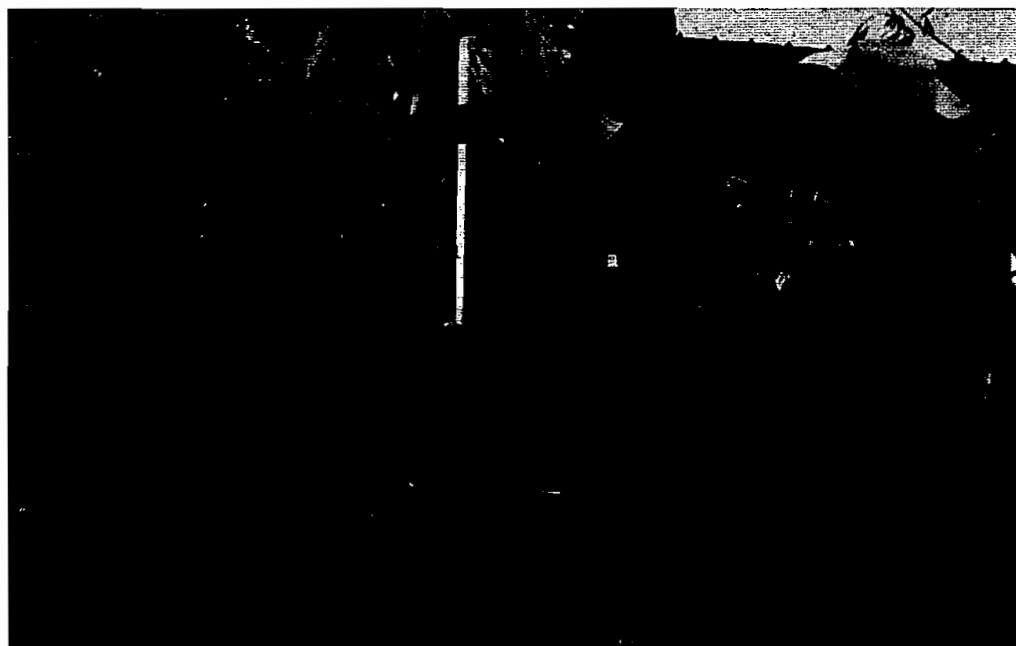


Photo 9.3 Extension service specialist training a neighbourhood volunteer leader in Panama City

are working explicitly to further urban agriculture. Neither the Asian Vegetable Research and Development Center nor the International Potato Centre [the world's leading vegetable and potato research facilities, located in Taiwan (province of China) and Peru, respectively] was conducting research focusing on urban production at the time of the study visit.

Case 9.4 Pro Huerta, a national agency in Argentina that supports small-scale urban farmers

In 1990, INTA (Instituto Nacional de Tecnología Agropecuaria), SAGP (Secretaría de Agricultura, Ganadería y Pesca), PFS (Programa Federal de Solidaridad) and SDS (Secretaría de Desarrollo Social) together formed Pro Huerta with aid from the government of Italy.

Pro Huerta listed over 500,000 beneficiaries in 1994 (up from 43,000 in 1991). These half-million Argentinians are supported at 62,000 community, school and institutional *huertas* (gardens) producing vegetables, fruit and small livestock (particularly rabbits). Pro Huerta reaches these small-scale and home farmers through 1,100 cooperating institutions in 1,800 towns and cities and its 13 regional offices.

The objectives of the programme are to improve nutrition and food security, promote small-scale in-town production and advance community participation in solving food-related problems. Its action programmes include training of trainers; enrolling institutions; providing inputs such as seeds, seedlings and livestock; and technical assistance in sustainable methods, including organic production.

Contacts: Daniel Norberto Diaz and Francisco D. Garra, INTA, Proyecto Pro Huerta/INTA, Alsina 1407, 2 Piso Of. 621, 1088 Buenos Aires, Argentina.

Although a few urban specialists can be found in the agricultural research institutions of countries such as Japan, China, the Netherlands, Tanzania, the Philippines and Canada, they are relatively scarce, especially in the rapidly urbanizing developing countries where they are needed most. When urban-relevant research is undertaken, there may be inadequate information exchange and communication among researchers or with technology transfer and extension agencies (primarily non-governmental and development agencies).

Few *extension* services address the problems of urban farmers, and even less training is designed specifically for them. Argentina is one of the few countries with an integrated national-level agency that promotes urban agriculture (case 9.4).

The few training programmes that exist tend to be in specific, mostly upper-income farming systems such as poultry and market

gardening; and they tend to be technical rather than to cover aspects important to the overall success of urban farming enterprises (marketing, investment management, processing and so on). Extension services in Kampala, for example, are more available to richer farmers than to poorer ones. Forty percent of high-income farmers received visits from government extension workers in the early 1990s, compared with 5% of low-income farmers.¹⁵ In Kenya, where low-income urban livestock farmers lose more cattle than they sell on the market, veterinary services go to higher-income cattle raisers for two reasons: they pay extension agents a bonus, and their farms are more accessible than those of low-income urban farmers.¹⁶

Technology transfer and information dissemination in urban farming often occur through non-governmental organizations and through minority and immigrant farmers. Grassroots NGOs are in better touch with low-income urban residents than are government agencies, international agencies and private firms. However, only a few NGOs promote urban farming. Successful examples include the Centre for Education and Technology in Chile, the Undugu Society in Kenya, the Commercial Farmers Bureau in Lusaka, the Urban Food Foundation in Manila and Peru Mujer in Lima.

International agencies should consider increasing their support for urban agriculture programmes. Most international assistance to urban farming has focused on family nutrition and on introducing certain exotic crops and farming systems, many of which are unsuited to low-income urban families. Some of the more successful urban agriculture assistance programmes have actually been funded as rural programmes. Examples include peri-urban market gardens (such as the International Fund for Agriculture Development's gardens for women in Senegal and those of the Food and Agriculture Organization in Côte d'Ivoire) and various forms of aquaculture (such as in Panama).

Too often, international assistance programmes for urban agriculture are small in scale and short-lived, lasting only a year or two. It may take considerably longer (perhaps five to eight years) to introduce a new farming system, since fine-tuning and a prolonged diffusion process may be required. A study of home and community gardens in the slums of Lima found that projects promoted by local and international agencies fail for several reasons: they are poorly implemented, use inappropriate technologies and crops or stop too soon.¹⁷

Special risks of urban farming

Unlike most other industries, urban agriculture produces mostly in the open. Urban farming, therefore, is particularly subject to theft because most people passing by will have some need for the product, whether food or fuel. Several surveys have reported that loss of crops to theft and lack of police protection are among the most common problems of urban farmers.

The problem of theft of crops is most serious for farmers who farm on open land far from their home. Upper-income and corporate farmers are more likely to farm inside closed yards and at secure sites at the fringes of the city. Poorer farmers, by contrast, generally plant on unguarded public land or on private land to which access has been acquired illegally or informally. Their risk of losing crops to theft is therefore particularly high, but they have little or no recourse to police assistance.

Urban farmers confront this problem in several ways, all of which have drawbacks. Some grow low-value crops, particularly if they are farming along unguarded and highly accessible roadsides, which reduces returns to labour. Others, particularly in larger peri-urban sites, pool resources to hire guards to watch over the fields, a costly measure. Still others harvest before the crop reaches its peak, which reduces the market value.

Lack of insurance makes farming ventures all the more risky in the face of disasters, whether natural or manmade. Rural farmers suffering a widespread catastrophe may receive compensation or assistance



Photo 9.4 High wall protecting an orchard in Lima. Protective walls are often much more basic than the one shown here.



Photo 9.5 Rice mill at a women's cooperative in Dakar

from the government, but not the unrecognized urban agriculturists. Farmers organizations that provide shared risks and responsibilities may be one solution to urban agriculturists' lack of insurance.

Postproduction constraints

Urban farmers are also handicapped during the postproduction phase by inadequate processing, storage, packaging, distribution and marketing facilities.

The lack of processing capacity for urban agricultural products stymies the growth of the industry.

Many products benefit from quick or early processing and packaging, such as fish and easily damaged fruit. The need for freezing plants, cold storage facilities, purpose-designed packaging, canneries and so on therefore is great (case 9.5).

Case 9.5 Cooperatives for livestock production, processing and packaging: Urban Food Foundation, Manila

The Urban Food Foundation, an NGO based in Manila with the objective of promoting food security and reducing poverty, facilitates the formation of diverse farmers cooperatives in Metro-Manila (see also case 3.4). These include cooperatives that serve farmers growing small livestock, either on small farms or by grazing on public land in the city.

The cooperatives help the farmers increase their profits and management through forward integration. They arrange for direct marketing of livestock products, including contracts with supermarkets, eliminating middlemen. To do this, one cooperative has established a slaughterhouse and packaging plant with help from the foundation. Whereas producers previously sold at a buyer's price on the hoof, they now sell wrapped finished products to retailers at a negotiated price. To accomplish this, the farmers pay for a full-time professional manager and an assistant.

The project received support from various international agencies for start up in the mid-1980s and is now financially secure.

Contact: Roberto S. Guevara, Urban Food Foundation, Quezon City, Philippines.



Photo 9.6 Packaging herbs in Abidjan

In most countries, processing, storage and packaging capacities are oriented to rural agriculture. Although these facilities may be located in towns and cities, they may not be able to cater to smaller-scale urban farmers. They deal in large packages and are controlled by large operators, who transport from rural areas to wholesale markets that distribute to retailers or large supermarkets.

Similarly, urban food markets are designed, often since colonial times, to import food from rural areas. Input-producing agribusinesses are geared to serving rural agriculture. The input and output market systems and infrastructure thus favour rural agriculture. The market structure may be composed of large wholesalers purchasing directly from rural areas or from intermediate, wholesale markets at the edge of the city and supplying retail outlets throughout the city. Smaller urban farmers generally do not fit well into this structure.

Some wholesale merchants may not be willing to do business with small producers. Larger urban farmers, by contrast, usually have the resources to market through such a market structure. They may also be large enough operators to be able to sell to wholesalers. Small- and medium-scale farmers need either a community-based market where they can sell their produce directly or a middleman or agency to sell to retail outlets for them (case 9.6). Inadequate market information can also hinder small farmers' ability to plan.



Photo 9.7 Home-processed salsa being sold at a market in Managua

Case 9.6 Saturday market for urban produce in Managua

Produce in Managua, Nicaragua, had been marketed in the overcrowded central market for generations. Over time, the market had become corrupt, controlled by a few agents and dominated by large food traders. It also was difficult for small urban farmers to sell their produce.

In 1990, the mayor's office found a solution to the problem. It created an alternative Saturday market, located four miles from the central business district, where stalls can be rented at a low, fixed price. Vegetables, meat, eggs, prepared food and other produce are sold. The market is conveniently located for both farmers and consumers and has proved popular with both groups. What is more, it has provided an impetus to urban farming. Because farmers market their produce directly, there are few middlemen.

Contact: See source listed in appendix C.

Organizational constraints

A final constraint to the growth of urban agriculture is the lack of organization among urban farmers themselves. The wide dispersion and lack of cohesion of small urban farmers hinder the development of markets for both their products and the inputs they require.

Urban agriculture lacks organization in most parts of the world. This problem is particularly acute for low-income farmers. Upper-income farmers may be organized within high-value farming systems

or products. Although a few low-income farming systems, such as the fisheries in Calcutta (see case 3.5), are organized through farmers cooperatives at a regional level, cutting across urban and rural lines, these cases are few.

The fact that farming may be illegal or informal further reduces the likelihood that farmers will organize.¹⁸ Furthermore, low-income farmers frequently lack the means or information to organize themselves without outside help. Because they get no recognition by those outside their community and have no identity as a distinct industry, they neither perceive themselves as one nor function as one.

Farmers are generally aware that their lack of organization operates as a constraint. Some see it as the most important obstacle to the further development of their activity. They “dream of more collaboration and organization”.¹⁹



The potential of urban agriculture is constrained by limited access to the key ingredients that could make it successful. In most cases, the problem of access is not physical but instead administrative or cultural. In most cities and towns, the contribution that agriculture could make to the quality of city life is limited by sociocultural biases; poor access to resources, inputs and services; unnecessary limits on post-production operations and a general lack of organization.

Low-income farmers in the informal sector are particularly affected by these constraints. High-return farming practised by upper-income farmers, such as poultry and floriculture, is typically more organized. These systems tend to have more developed input and output markets, government recognition as agribusiness industries and more available credit; they are also more likely to be included in agricultural research efforts.

The key to unblocking the various constraints that now work against the industry is to increase awareness of the important role that urban agriculture can play. The next chapter begins to define a strategy and offers some suggestions about how this objective can be achieved.

Notes

1. Winrock International, *Annual Report*, African Women's Leadership in Agriculture and Environment Project (Arlington, VA: Winrock International, 1994).

2. Friedhelm Streiffeler, "General Principles and Approaches for Sustainable Urban Greenbelts with Special Reference to Africa", Technical University of Berlin, Department of Rural Sociology, 1993, p. 27.

3. Timothy Greenhow, *Urban Agriculture: Can Planners Make a Difference?* Cities Feeding People Series, report 12 (Ottawa: International Development Research Centre, 1994).

4. Donald B. Freeman, *A City of Farmers: Informal Urban Agriculture in the Open Spaces of Nairobi, Kenya* (Montreal: McGill-Queen's University Press, 1991).

5. Bishwapriya Sanyal, "Urban Agriculture: Who Cultivates and Why? A Case Study of Lusaka, Zambia", *Food and Nutrition Bulletin* 7 (September 1985): 15–24; Carole Rakodi, "Urban Agriculture: Research Questions and Zambian Evidence", *Journal of Modern African Studies* 26, no. 3 (1988): 495–515; Freeman, *A City of Farmers*; and Daniel Maxwell and Samuel Zziwa, *Urban Farming in Africa: The Case of Kampala, Uganda* (Kenya: ACTS Press, 1992), pp. 55–56.

6. Yue-man Yeung, *Urban Agriculture in Asia* (Paris: United Nations University, Food-Energy Nexus Programme, 1985)

7. Streiffeler, "General Principles and Approaches", p. 32.

8. Daniel E. Vasey, "Household Gardens and Their Niche in Port Moresby", *Food and Nutrition Bulletin* 7 (September 1985): 37–43.

9. Maxwell notes, however, that landowners often put their "land to short-term [farming] use, which kept squatters from being able to claim any access to the land." When the landowners reclaim their property, they don't have to compensate the squatters. Thus, "in some instances, farming actually serves the interests of both the landowner and the farmer." Daniel Maxwell, personal communication, 1993.

10. Maxwell and Zziwa, *Urban Farming in Africa*.

11. Luc Mougeot, personal communication, 1994.

12. Mougeot, personal communication, 1993.

13. Maxwell and Zziwa, *Urban Farming in Africa*, p. 57.

14. R.S. Ganapathy, personal communication, 1993.

15. Maxwell and Zziwa, *Urban Farming in Africa*.

16. Diana Lee-Smith and others, *Urban Food Production and the Cooking Fuel Situation in Urban Kenya: National Report—Results of a 1985 National Survey* (Nairobi: Mazingira Institute, 1987).

17. Vera Niñez, "Home Garden Programmes in Lima Slums", *Food and Nutrition Bulletin* 7 (September 1985): 6–14.

18. Streiffeler, "General Principles and Approaches", p. 27.

19. Streiffeler, "General Principles and Approaches", pp. 28–29.

P a r t

four

The future of
urban agriculture

Promoting urban agriculture through policy and action

Capturing the many potential benefits of urban farming, solving the problems that often accompany it and overcoming the obstacles to its further development will require policies and programmes to promote and regulate appropriate urban agriculture. This chapter suggests how to accomplish this challenging task.

Field visits and observations, a review of the literature and workshop discussions have revealed that most of the actions required to promote urban agriculture are being practised today in cities and countries across the globe. Much can be learned from the success stories as well as from the cautionary tales.

The next section considers the types of interventions that can be implemented to increase the range and effectiveness of urban agriculture. A second section focuses on which interventions are most appropriate at the community, city, national and international levels.

Interventions within and across sectors

If urban agriculture is to achieve its full potential, interventions are needed to:

- ▼ Increase public knowledge and support
- ▼ Build political will
- ▼ Improve organization and communication among farmers
- ▼ Develop a policy framework and build institutional capacity
- ▼ Expand research and training
- ▼ Improve access to resources, inputs and services
- ▼ Maximize health, nutrition and food security
- ▼ Achieve sound environmental and urban management.

Increase public knowledge and support

Broad appreciation of the benefits of urban agriculture is urgently needed to overcome both traditional and modern biases. Public information aimed at current and potential service organizations is perhaps the most effective tool to transform the industry from its cottage status into a major instrument in the battle against hunger and poverty. The means will vary with the organization being targeted. Local support organizations (non-governmental organizations (NGOs), community organizations and farmers organizations) can be reached most effectively through articles in newspapers and network newsletters, workshops and national and international networks of similar organizations. Development agencies, government agencies and researchers can be reached through journal articles, well-targeted newsletter articles, conferences and workshops.

Information about the benefits of urban agriculture is beginning to appear regularly in the mainstream news media.¹ But, as with most news reporting, the press pays more attention to bad news than it does to success stories. More balanced and analytical reports are needed.

Educating the next generation is critical to making urban agriculture a broadly understood and accepted industry. Primary agriculture education in schools—perhaps including outdoor environmental/agricultural classrooms—is therefore an essential component of any action plan to educate the public. Vocational training in urban agriculture practices can also be incorporated into the secondary school curriculum.

Build political will

Even in countries like Chile and the United States, where there are more urban than rural farmers, urban farmers remain invisible to both legislators and government administrators. Without political will, the legislative and policy changes needed for urban agriculture to achieve its potential will not be forthcoming—even if the public understands the benefits.

Political will can be informed and created through “policy training”. For example, one- or two-day leadership forums could be held to give politicians an opportunity to learn more about the contribution of agriculture and the challenges it faces directly from community and city leaders. Such forums could be facilitated by experts in

urban agriculture, environment, health and related topics to ensure full consideration of all critical areas. Field trips to production sites and to cities or countries where urban agriculture is well managed will also go a long way to convince political leaders and government administrators of the benefits of urban farming.

With the support of the United Nations, many cities worldwide have adopted policies and programmes for becoming a “green city”, an ecologically “sustainable city” or a “healthy city”. Such policies and programmes also contribute to building political will. Green cities and healthy cities are empowered by urban agriculture. A programme of “cities that feed themselves” could help build political will for urban agriculture.

Regional and global forums can also produce significant results. During 1994, urban agriculture was discussed by civic leaders, including mayors, at a global forum in Manchester, England, and at an international colloquium of mayors in New York City.² The 100 mayors assembled in New York City agreed that urban agriculture (along with job generation and microenterprise development) would be their first action to fight poverty.³

In many countries, relevant data can contribute to building political will. In places where politicians respond to appeals to support the farmer (rather than simply the agricultural product), data on the number of urban farmers and their contribution to urban and national well-being will be invaluable. Urban farmers in Italy, Japan and Germany already have a political voice.

Efforts to build political will are needed in all of the sectors in which urban agriculture is effective: food, energy, urbanization, environment, agriculture and health. However, as long as urban agriculture continues to be as unorganized as it is in most countries, the political will to support it is likely to be missing. Organizing farmers will therefore continue to be a front-line intervention.

Improve organization and communication among farmers

As previously noted, the general lack of organization among farmers—especially lower-income farmers—is partly due to their physical isolation from each other. For this reason, efforts to educate the public about the agriculture sector and its benefits should include farmers as well.

Also important are interventions to help farmers organize into cooperatives and associations and to facilitate the development of existing organizations. Assistance may also be needed to enable some existing NGOs to take on urban agriculture; new NGOs could also be established, with input or direct participation of farmers. All these actions would ultimately create economies of scale, making urban farming more competitive and more profitable.

As communication contributes to an ever-shrinking world, it is increasingly common to borrow forms of organization across national and continental boundaries. Models of ideal organizations and work plans for this “new” urban industry are urgently needed.

A participants network can facilitate communication among farmers as well as information dissemination. The Urban Agriculture Network is one such network, as is the network formed recently in Latin America; a network is also being formed in Asia. Such networks can reach urban farmers; they also can help to coordinate actions with intermediary agencies. Networks in related areas such as nutrition, sustainable agriculture and microenterprise development can be linked.

Finally, improved organization of farmers would have benefits for production as well as improved access to preproduction and post-production facilities.

Develop a policy framework and build institutional capacity

Initiating or significantly increasing the scope of urban agriculture will require changes in government policy as well as in the functions and priorities of some agencies and institutions.

National policy has an important role to play: governmental designation of agriculture as a beneficial urban land use and economic activity is likely to provide critical impetus to the industry's growth and success. In general, if policy addresses urban agriculture at all, it tends to make the practice illegal. More logical policies are needed on the type and location of cultivation and livestock that are permitted. The choice of policy tools available to municipal and national governments include legislation, public education, structured incentives and retrofitting agencies to regulate and support urban agriculture.

Endorsements by high-level public officials—such as those by Zambian President Kaunda in 1977 and Tanzanian Prime Minister

Sokoine in 1980—can have a powerful, positive effect on public officials' view of urban farming. And by including urban agriculture in census and other data collection, governments can send an important signal about the key role the industry plays in the national economy.

In most cities, provinces and countries, urban agriculture does not come under the exclusive agenda of any ministry or government department; it therefore falls between the cracks. The appropriate department to oversee urban agriculture will vary from country to country; possible candidates include the ministries of urban development, agriculture, environment and labour. Where urban agriculture is part of a national government's agenda, it most commonly is part of the agriculture ministry.

None of the studies reviewed during this investigation compared the administrative organizations and regulatory frameworks of cities that support urban agriculture and those that do not. The differences in health codes and enforcement, food regulations, environmental regulations, police accountability, waste management administration and so on should be examined. Comparative studies will provide important input in designing alternative institutional structures needed to manage urban agriculture.

Training is needed to build the institutional capacity to provide effective oversight of the sector's activities. Most crucial will be training for government personnel who will monitor the riskier techniques used in urban agriculture. In particular, the application of solid and liquid waste to farming will need to be managed carefully.

Expand research and training

The most pressing research need is to develop tools to eliminate the constraints that hinder urban agriculture's development and solve the problems associated with current practice.

Studies and data are needed to help urban farmers gain credit ratings from banks, to improve small-scale producers' access to wastewater, to assist agribusiness in serving urban farmers, to give the same urban agriculture opportunities to low-income mothers as are now available to well-financed businessmen and to make food produced within cities consistently safe. Research to increase productivity and improve the environmental, health and urban management record of urban agriculture is also needed.

Urban agriculture is an emerging research field, and its parameters and methods must be defined. Urban agriculture was “discovered” separately by social scientists, urban planners and agronomists. Each discipline brought its own past practice to the “new” field. Research methods used in urban agriculture today are an eclectic mix. A focused, short-term effort is urgently needed to reach agreement on research methods among the small number of urban agriculture researchers so that greater comparability across data sets becomes possible.

Conduct baseline and farming system surveys

Surveys are needed to generate data on the current state of urban agriculture as well as projections of its future potential. These data are needed both to convince investors, supporters and promoters of the benefits of urban agriculture and as input into the process of formulating policies and interventions for this sector. The impact of future interventions can be measured against this baseline data. Specifically, data are needed on:

- ▼ The extent of urban agriculture
- ▼ The structure of the sector
- ▼ Demand and supply
- ▼ Input and output markets and links
- ▼ Efficiency of the production activity
- ▼ Technologies and farming system mix
- ▼ Nutritional and health impacts of farming
- ▼ Environmental impacts.

Both baseline surveys and farming system surveys will reveal the current status and extent of farming in a particular city. A baseline survey could include a land survey to establish which parts of the city are currently farmed and which could be farmed. It could also include a market survey and a household survey to establish the percentage and type of residents who are farming as well as details about the farming activity. A number of broad-based surveys have been undertaken in the past few years. It may be feasible to review the best of these surveys with a view to devising an efficient baseline-survey instrument.

Farming system surveys study a particular farming system or subsystem in depth (for example, horticulture and fisheries or, more specifically, hydroponics or wastewater-based lagoons). Farming system surveys identify the production process, producers,

technologies, inputs, markets, linked sectors (input and output industries, credit agencies, extension and research agencies), beneficiaries and ecological, economic and social impacts. Such surveys are needed to define the existing and potential benefits, as well as the needs (research, credit and so on) of each farming system. They should also provide information on the linkages among farming systems; information on any synergy between specific crops and, more broadly, between systems is crucial to the design of successful urban agricultural systems.⁴

Identify and transfer best practices, models and technologies

The most appropriate urban agriculture technologies in any city or country often can be found by seeking the local “best practice”, that is, the farmers who produce the greatest output per unit of land or labour. The goal would then be to advance the production level of all farmers to that of the local best practice. Interventions may be needed to document the best practice, to arrange farmer-to-farmer visits and to support the best-practice farmer to become a teacher and coach.

Model or pilot projects are needed to identify for policy-makers, research organizations, bankers and support agencies what the benefits of urban agriculture truly are. Projects are also needed in some countries to provide farmers organizations and government departments with models for investment. (Case 5.3 reports on the success of this approach in Viet Nam.)

Interventions to support technology transfer have many successful examples in some farming systems, particularly aquaculture. Support for these programmes is quite urgent to increase not only yields, but also the number of crops, as well as to advance “safe food” methods. Technology transfers are generally easier to accomplish within a country or region rather than across regions. Thus the last decade’s spread of popular hydroponics from Bogotá has been limited to Latin America.

Four types of training are urgently needed for this burgeoning industry:

- ▼ Policy training for executives and politicians
- ▼ Management training for NGO directors and heads of government agencies
- ▼ Extension training for government and NGO extension agents
- ▼ Production and business training for farmers.

Training in urban agriculture generally is best accomplished by the farmers themselves. In this way, a farmer who is proficient in a best practice passes his skill and knowledge directly to another farmer. Similarly, the leaders of the most effective NGOs should train other NGO leaders within a country.

Improve access to resources, inputs and services

One of the greatest obstacles for urban farmers is a lack of access to credit. Possible means of increasing the amount of credit available to urban farmers include (a) providing a special line of credit for urban farming entrepreneurs, (b) reserving part of an existing agricultural credit quota for urban farmers and (c) including urban farming among the industries eligible for special small-enterprise support.

Urban farmers often do not achieve maximum yield on a new site for three to five years. Support programmes, or soft loans with possible delay of repayment during the first couple of years, therefore may be desirable in the early years of promoting urban agriculture in a particular town or city.

To improve the access of small- and medium-scale urban farmers to markets and to market information, government departments could (a) create market-places for small farmers, (b) provide incentives for operators in the market to cater to small- and medium-scale urban farmers or (c) help farmers to form marketing cooperatives. In most cities, research will be needed before such programmes can be initiated. Moreover, business and other training for farmers can help them better plan their crop choices and manage their products up to the point of sale.

Finally, urban agriculture requires strong links with other industries to achieve its potential (see chapter 6). Interventions by NGOs, community-based organizations or municipalities may be needed to ensure the timely establishment of these links, especially for small-scale producers and processors.

Maximize health, nutrition and food security

Safe food is a prime concern of public authorities as well as many families. Dependable year-round access to a well-balanced diet is the prime concern of at least half of urban residents in Asia, Africa and Latin America who live at or below the poverty line. Urban agriculture can contribute to improving both food safety and food security.

In urban and rural areas alike, chemical and organic pollutants are of concern. In urban areas, the controls need to be more stringent because farming is in close proximity to dense human activities. However, enforcement may be easier to carry out because the activities are not dispersed in remote areas and are more accessible to hygiene specialists.

Food safety standards have been published by several international agencies, but these are global and must be adapted to match each city's conditions and farming systems. Regulations are needed to control which crops are grown where and which farming methods are used (for example, peas can sometimes be grown where lettuce is inappropriate).

To some degree, where there is a good information system, the market will assist the regulatory function. In La Paz, Bolivia, vegetables grown above the city sell at a higher price than those grown below it because the market recognizes that polluted irrigation water flows downhill.⁵

The question has been raised whether it is reasonable to expect weak local governments to regulate agriculture within and at the edge of their cities. In general, prohibiting urban agriculture completely has been found to be infeasible, in part because of its extensive nature and farmers' economic need. Some countries, both more and less developed, have regulated urban agriculture successfully for decades. Most countries today have food safety regulations, but there are gaps in enforcement. Assisting municipal and national governments in devising ways to effectively control urban farming practices may be one of the most necessary interventions.

Regulations can be introduced on a step-by-step basis. First, the most dangerous problems and most urgent needs are targeted, for example, prohibiting the use of industrial and hospital waste as agriculture inputs, disallowing certain crops on highway verges and checking irrigation water quality at a few points seasonally. The use of secondary indicators, such as levels of diarrhea, may provide a guide to trouble spots or dangerous processes. Then, gradually, less urgent issues can be addressed.

A case in point is the situation in Asmara, Eritrea. More than one-third of the vegetables consumed in the city in 1994 were produced with sewage irrigation. There is no short-term alternative source of vegetables within the country, and importing vegetables is not financially or physically feasible. A step-by-step programme of enforcing

regulations that ensure adequate wastewater treatment may be appropriate to prevent outbreaks of contagious diseases.

Strategies to achieve a more equitable distribution of food and to increase the food security of the poor include food subsidies, rationing, food stamps and differential pricing. However, subsidies and price controls are costly measures that are difficult to target to needy populations and, like rationing and food stamps, they create dependence on food assistance. Urban agriculture, by contrast, makes the target population nutritionally self-reliant and empowers it. Because urban agriculture is a self-sustaining strategy that can reduce future dependence, it reduces the burden on public resources.

In her analysis of urban nutrition policies, Atkinson identifies the advantages of farming for self-consumption relative to other measures: it “generates independence, makes use of idle resources, improves the quality of the environment, increases the amount of available resources and establishes new bonds between the urban and natural environments which seem increasingly important for the city as a whole.”⁶

For low-income residents, urban agriculture-related nutritional support measures might include extension services and access to land on a permit basis. Programmes directed towards the poorest of the poor can additionally include provision of subsidized inputs and water and low-interest credit without collateral requirements. Such interventions to promote community production of food not only cost less than direct food aid; they have the additional advantage of being temporary.

In the case of middle-income residents, interventions could be designed to provide nutrition education, extension support and improved access to needed inputs, resources and markets.

Policies and regulations favoring urban agriculture should recognize the important environmental health benefits of maintaining otherwise derelict land and water, improving physical access to food (in portions of the city poorly served by food outlets) and enhancing the quality of the food produced.

Where malnutrition is endemic, the health care system could promote farming as a strategy to ensure family and community food security and greater family control over the nutritional content of meals. In Lusaka, for example, agencies encourage the poor to produce vegetables for consumption to increase their vitamin and micronutrient intake.⁷ School, health clinic and community garden programmes

can also promote community and home farming as a nutritional solution, as illustrated by the case of the *comedores populares* in Peru (see case 7.1).

Development agencies with programmes to help the rural poor improve micronutrient intake through farming vegetables, fruits and livestock in home and community farms include Africare, Save the Children Federation, Plan International, CARE and UNICEF. These international agencies could expand such programmes to include the urban poor.

Poverty reduction and economic development programmes can go a long way towards achieving their objectives by including urban agriculture among their strategies. In some urban communities, families spend more than 80% of their income on food and fuel. Food security frees money for expenditures on other items, thereby promoting economic growth. It also drives entrepreneurship. Any intervention to promote urban agriculture is therefore an economic intervention.

In many cities, more than half of the microenterprises are engaged in food production and food processing. Trickle-Up Program found in 1994 that 60% of its 8,000 very small enterprise projects were food related.⁸ Towns and cities with economic development goals can do well with urban agriculture projects in both poor and middle-class communities.

Achieve sound environmental and urban management

One of the biggest policy changes in government today is the inclusion of environmental policy in urban policy. As described in chapter 1, the goal of replacing open-loop systems with closed-loop systems should lie at the core of environmental policies. Urban agriculture can be an integral part of a set of policies that advocate closed-loop development.

Green spaces improve the living environment, aesthetics and climate. Policies to promote such greening efforts should be based on productive landscape principles: gardens can be a mix of farming and recreation space, and street trees can be fruit- and nut-bearing. Farming reduces and privatizes the maintenance cost of such green spaces because the farmers maintain the land while they farm it. Cities as different as Chicago and Addis Ababa have agroforestry programs to improve the environment and climate and (in the case of Addis Ababa) to provide an improved fuel wood supply.

Land use management

In most developing countries, farming is not included in urban land use policy. Cities would do well to include urban agriculture as a land use that works towards a more balanced and ecologically sustainable urban development pattern that conserves natural resources. Zoning and building regulations could be used to shift urban development planning towards “productive landscape”, thus opening up opportunities for urban agriculture. Transforming polluted land into productive land is a key concept.

When urban land uses include agriculture, city planners have greater leverage; they can place into productive use lands that are unsuitable for built-up uses or those that have a particular natural resource value (for example, aquifers). Thus land rent is increased and natural resources are conserved.

To adopt a policy of urban agriculture as a productive land use, planning departments need to identify public spaces that should be put to farming use as well as unbuildable areas (public or private), such as steep slopes and marshes. Most cities have significant amounts of vacant public land where farming is practical.

The potentially available land can be categorized as government-owned land, land owned by public agencies, privately held land or hazard-prone land. The particular policies needed to make land available for farming depend on the land ownership patterns in the country or city. In cities where the government owns a large share of the land, it may be easier to provide land for farming through policy measures.⁹

Sanyal has suggested five policy measures to provide urban land for farming:

- ▼ Give farmers access to public vacant land
- ▼ Induce owners of private land to allow temporary access for farming
- ▼ Put land around public facilities, such as schools, ports and hospitals, to farming use
- ▼ Improve land for agriculture and aquaculture by dredging, filling, levelling, terracing and so on
- ▼ Design site/service areas for squatters and other low-income residents to provide them with farming space.¹⁰

In reclaiming derelict land, the government can follow a policy of allotting land to volunteer low-income farmers in return for reclamation

work. Including space for farming in government housing schemes for low-income residents would benefit the government by increasing residents' income and thus their ability to make monthly payments. To keep control over land that may be needed for another use in the future, lease agreements specifying the duration may be appropriate, whether the landowner is public or private.

Other appropriate interventions in land use management and planning include:

- ▼ Cost-benefit analyses of the use of various lands and water bodies for farming, as input into the planning process
- ▼ Legal structures for tenancy agreements and use of land for farming
- ▼ Regulations restricting farming on fragile lands, lands needing conservation, floodplains, steep slopes and land over aquifers.

Most of the arguments made here about access to land apply equally to surface water in ponds, lakes, rivers and estuaries. However, access to water bodies by government permit is usually obtained more easily than access to land that forms part of the public domain.

Urban agriculture can be a beneficial component in many urban projects. In a housing project, for instance, urban agriculture can make productive use of some of the unbuildable portions of the site, thereby improving the rate of return. It may also provide income during the build-out period of the project. Infrastructure projects can benefit when rights-of-way are put to productive use or urban agriculture provides maintenance of open spaces, such as those at an airport. Urban agriculture is also an excellent buffer, for safety or other purposes, between incompatible land uses. Industrial sites with long build-out phases can benefit from urban agriculture for years. Park land acquired for future use can serve to feed the city until it is needed for leisure. Agriculture is also a good interim use of land in urban renewal sites at city centres.

Disaster management

Urban agriculture can be included as a strategy in a city's disaster management policies. Traditionally, flood disaster management strategies have included damming rivers and leaving floodplains and steep slopes vacant. Urban agriculture is a more sustainable and preventive strategy. By planting crops and trees upstream and on steep slopes, soil erosion and excess runoff can be prevented and disasters avoided.

The planting of crops and trees across a flood path reduces the force of the water.

A partial answer to a drought crisis is to promote urban farming methods that use little water. Finally, economic and political disasters are often mitigated by urban agriculture. Sarajevo is the best known recent example; Baghdad is another.

Waste management

Urban agriculture can play an especially vital role in waste management—both waste that is usable in farming and waste created by farming. Transformation of waste into food and fuel is essential if a city is to attain the full benefit of urban agriculture.

Citywide waste management systems are usually centrally managed, making it virtually impossible for farmers to have legal access to the wastewater and solid waste. A new approach is needed in which collection, sorting, treatment and recycling take place at the community level in cooperation with local organizations.

Local waste management systems can be introduced on an incremental basis, beginning in areas with greatest potential to use the waste in farming. Government requests for proposals could produce a range of alternative approaches to handling biological wastes using both traditional and new technologies.

Policy changes are also needed to move towards a wastewater management system based on purification through aquatic plants and animals as well as reuse of the purified water for irrigating urban and peri-urban fields. Well-tested and -established examples of both processes exist and can be gradually implemented, perhaps beginning with sewage lagoons. Biological processing of wastewater and solid waste makes urban agriculture both more affordable and more sustainable.

To prevent food contamination, new standards and procedures need to be instituted for processing and treating wastewater and solid waste, as well as for applying them to farming. Standards developed by the Food and Agriculture Organization, the World Health Organization and some industrial countries can provide a start.

For centuries, provision of water has been recognized as an appropriate function of local government. Once agriculture is again recognized as an appropriate urban industry, policies to provide it with controlled access to wastewater (as well as to surface and groundwater) will also become appropriate.

Intervening at the most effective level

This section addresses the four levels at which action is needed—the community, city, national and international levels—and discusses the interventions appropriate for each one (summarized in table 10.1). Many of the interventions can occur at more than one level. Most of the national and international interventions serve to facilitate the interventions at local levels.

Table 10.1 Community, city, national and international roles in promoting urban agriculture

Activity	Role			
	Community	City	National	Inter-national
Research and information				
Survey and document	▲		▲	
Disseminate information	▲	▲	▲	▲
Conduct research				▲
Create model codes and standards			▲	▲
Projects				
Include urban agriculture in projects	▲			▲
Create model projects				▲
Conduct training	▲			▲
Access to services and resources				
Improve access to inputs and services	▲	▲		
Provide research and extension		▲	▲	
Improve access to credit	▲	▲	▲	
Create and structure markets		▲		
Provide financial incentives			▲	
Provide access to public land, water and waste		▲	▲	
Policy and planning				
Adopt policies linking urban food and nutrition with urban farming		▲	▲	
Integrate urban agriculture into planning (food, energy, waste, land use and environment)		▲	▲	
Enact legislation		▲	▲	
Regulate		▲		
Develop institutional capacity		▲	▲	
Cooperation				
Foster global and regional cooperation		▲	▲	▲
Foster cooperation among involved groups and individuals	▲	▲		
Help farmers to organize	▲			▲

Source: The Urban Agriculture Network.

Because most of these interventions have been discussed in the previous section, they are not detailed here.

Community-level actions

Community-level interventions that can be carried out by community-based organizations, local NGOs, farmers associations and ad hoc committees include the following:

Integrate urban agriculture into ongoing projects and activities in education, environment, food, health, housing, community development, waste management and so on. Urban agriculture flourishes in partnership. In isolation, it has the greatest potential to cause negative impacts.

Conduct surveys to document the status of urban agriculture, and inform local government, institutions and the public of the survey results. Typically, the extent and character of urban agriculture in a city are poorly understood. Community leaders may choose to conduct a survey (possibly assisted by secondary school students) and to make a visual record to share with interested groups and individuals.

Improve access to land, water, credit, extension services, inputs and security. Action in this area may require interaction with municipal, state, banking, business and other organizations. Survey data and other evidence will help make the case for action.

Provide training in good practice. Skills will exist in the community; these skills may need to be upgraded in light of nutrition, health, environment and enterprise concerns and opportunities. Best practices will be found within the community or in nearby communities. Farmers skilled in each best practice should serve as teachers and coaches.

Establish partnerships with NGOs, the municipality, a university, the media, food and health authorities and rural farmers. Community organizations have a role to play in facilitating access to technology, market information, technical advice, crop security and so on.

Assist in organizing urban farmers. In some cases, farmers will require assistance from community groups to establish an effective affinity or solidarity organization.

City-level actions

City governments and other citywide organizations can undertake the following actions:

Initiate a citywide study and discussion programme as background to formulating and adopting a policy of regulating and/or promoting urban agriculture. This action can be taken in concert with community groups, affinity groups, other cities and national organizations. It can also have input from international organizations.

Adopt enabling legislation. Modifying health and land use regulations is the most common way to encourage urban agriculture. National government support may be required.

Recognize agriculture as an urban industry. The distinction may vary to include food and fuel production, waste management, environmental and land management and community development. Urban agriculture also should be included in the municipal data collection system.

Create an institutional structure to promote and regulate urban agriculture. One possibility is for the municipality to establish a department that provides extension and information.¹¹ Urban agriculture requires up-to-date information on markets, disease, inputs, security and so on. The municipality can provide such a service independently or in cooperation with other groups. In concert with banks and technical institutions, the city can offer credit and extension services. Municipal policies giving citizens the right to farm idle or “sleeping” land with the permission of a local council would help to secure tenure for many small entrepreneurs.

*Create a city-level food system plan, including both rural and urban supply sources.*¹² A food and energy partnership between a city and its hinterland can be beneficial to both through sharing information as well as resources.

Integrate the waste management system with the food system. An integrated system includes collection of waste, treatment, supply to urban agriculture and monitoring of the entire process (see case 9.3).

Establish a programme and plan for achieving environmental sustainability utilizing urban agriculture. For most larger cities, urban environmental sustainability should include municipal or metropolitan programmes for food and fuel production. These would include forestry and disaster mitigation.

Prepare a land use plan and regulation system that provides access to land, water and markets for urban farmers.

Establish and regulate a public and worker safety programme. If poorly practised, urban agriculture is dangerous to its workers and to the public. Regulations, developed in conjunction with farmers and communities, are needed.

Provide support for disadvantaged citizen groups. Urban agriculture is particularly effective as a poverty-fighting tool and especially appropriate for women's initiatives. Municipal programs to eliminate poverty and empower women can include urban agriculture.

Structure the market and create market-places for urban farmers.

Provide training in urban farming methods.

National-level actions

Institutions that act at the national level include the national government and its various ministries, NGOs, universities and research centres. The kinds of actions they can take include the following:

Establish an urban agriculture policy. National policy may be more flexible than city-level policy. The concern for the impact on rural food and fuel producers may be greater at the national level. Moreover, national policy can have a great effect on city policy. Environmental policy can include guidelines for putting environmentally vulnerable and resource-critical land and water areas to conservation uses, including agriculture.

Create a national food policy that establishes synergy between rural and urban production systems and guides an urban-rural agriculture integration programme. This would complement food system planning undertaken by individual urban regions, particularly in small cities where planning capabilities tend to be limited. National intervention will also be called for where past national agriculture programmes have been exclusively rural and there is a need to extend research and extension to include urban farming.

Include urban agriculture and forestry in national energy and forestry plans. Urbanization is the prime cause of energy and forestry problems and must be included in the solution.

Provide research and extension services. Municipal governments generally have little capacity for research. Most national governments have agricultural research and extension facilities that can be expanded to include urban agriculture (see case 9.4). National organizations can facilitate the sharing of information among cities both within and outside the country.

Provide tax alleviation, or subsidize inputs, for urban agriculture. It may be appropriate to devise a system of national incentives, at least for an interim period, to realize the full range of benefits.

Prepare model health and land use codes. The development of model codes in areas such as public health, land use, waste management

and water conservation could significantly aid small and medium-size towns and cities.

Conduct surveys and collect and disseminate data. Beginning with census and employment data, there are many national or sample surveys that can include urban agriculture. National-level efforts to develop data on nutrition, land use, pollution, food systems and energy could make a significant difference.

Facilitate access to public land and waterways. Airports, highways, hospitals, military bases, universities, forest parks and many other nationally owned lands can be made available for urban agriculture as an interim or permanent land use. Rivers, estuaries and bays suitable for aquaculture are also typically controlled by the national government.

Facilitate cooperation between farmers groups and both public authorities and large private corporations. Electricity, telecommunications, ports, railroads and parks authorities are often established as extensions of national governments. Their partnership with urban farmers associations may be critical in some cities.

Establish a system of credit. Existing national schemes for credit to agriculture and small businesses can be extended to include urban farming.

Establish a system for facilitating cooperation between farmers and local organizations, on one hand, and regional and global agencies that support urban agriculture, on the other. Global organizations along with their regional branches are beginning to offer assistance in urban agriculture. This assistance can be facilitated by a national ministry that communicates with individual cities or national NGOs.

Train trainers, leaders and monitors. The training of trainers and leaders can be carried out on either a national or a regional basis; these leaders/trainers can then organize and oversee farmer-to-farmer exchanges and local training.

International-level actions

Urban agriculture may not require long-term support. International support, however, is needed on an interim basis. During the next decade, assistance will be needed for start-up efforts by nations, cities and NGOs. During that time, and for a few years thereafter, some support will be needed for technical cooperation among developing countries, for special farming systems and for trouble-shooting on issues such as disease and pollution.

Global data sharing, information exchange and networking will continue indefinitely and should be self-supporting. Regional urban agriculture networks are beginning to form.

The actors involved at the international level include the United Nations and its specialized and associated agencies, research centres, development banks, bilateral and multilateral assistance agencies and international NGOs. The tasks they can perform to promote urban agriculture include the following:

Develop agreement on common research methods. A conference of leading researchers is needed to develop and reach agreements on research guidelines.

Develop model codes that can serve as a basis for national and city regulatory programs. Codes are particularly needed on the use of public and private land, the use of wastewater and the use of ecologically sensitive land and water areas.

Develop model projects to provide knowledge of improved urban agriculture practices to local project agencies.

Conduct surveys across national boundaries to compare the industry's performance by climate zones and in similar economies. Comparative studies of farming systems, subsector economics, environmental impacts, the role of women and nutritional impacts in different cultures, for example, can contribute valuable information.

Retrofit existing and new projects to include urban agriculture. This task can be done in the areas of food systems, the environment, energy, agriculture (research marketing, extension), forestry, utility infrastructure, urban management and waste recycling, as well as for such initiatives as National Environment Action Plans.

Identify models of organization for urban agriculture. There are several effective local and national governmental agencies across the globe. These could be described and profiled as models for other cities and countries. Public-private partnerships that have been successful in promoting the industry could be elaborated into a few prototypes or models.

Develop regional and global networks.



As the global trend towards greater urbanization continues, urban hunger is increasing in both rich and poor nations—particularly among the most vulnerable groups. And as cities are growing, urban environments are deteriorating. Urban agriculture has the potential to address hunger, poverty and urban environmental degra-

dation in a sustainable way. What is needed now are efforts—at all levels and by both public and private interests—to put in place regulatory and support systems that can help the urban agriculture industry to flourish. These systems must be designed to solve the problems associated with the poor practice of urban agriculture, to reduce the constraints hindering its development and to capture its many potential benefits.

Notes

1. BBC World Radio, *The World Paper* (published monthly in 24 cities around the globe) and the *Wall Street Journal* all have covered urban agriculture.
2. Global Forum. 94 was held on 24–28 June 1994 as a follow-up to the Earth Summit in Rio de Janeiro (the United Nations Conference on Environment and Development). The International Mayors Colloquium in New York City was a preparatory conference to the Social Summit held in Cairo in 1995.
3. International Colloquium of Mayors on Social Development, “Mayors’ Declaration on Social Development and Sustainable Human Settlements”, United Nations Development Programme, New York, 19 August 1994.
4. J. Sumberg, U. Kleih and R. Grand’Pierre, *Production and Marketing of Vegetables in the Port-au-Prince Peri-urban Area: A Sub-sector Study*, Report for CARE International-Haiti, 1994.
5. Juan Arbona, SEMTA, La Paz, Bolivia, personal communication, 1994.
6. Sarah Atkinson, *Food for the Cities: Urban Nutrition Policy in Developing Countries*, Public Health and Policy Departmental Publication 5 (London: London School of Hygiene and Tropical Medicine, 1992).
7. Robert Ledogar, “Food and Nutrition in Squatter Areas: A Case Study of John Howard in Lusaka”, report prepared for the American Friends Service Committee (Lusaka, Zambia: 1978).
8. Trickle-Up Program, Annual Report (New York: Trickle-Up Program, 1993).
9. Bishwapriya Sanyal, *Urban Cultivation in East Africa: People’s Response to Urban Poverty* (Paris: United Nations University, Food-Energy Nexus Programme, 1986), pp. 48 and 53.
10. Sanyal, *Urban Cultivation*, pp. 56–63.
11. This is what the city of Jakarta, Indonesia, has done, forming an agriculture department with specialized divisions staffed by professionals (see case 2.4).
12. The city of Hartford, Connecticut, has a non-governmental organization that coordinates urban and rural food production, with the aim of metropolitan food self-reliance.

Appendices

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Glossary

Aquaculture—Agriculture based within various bodies of water. It includes seaweed, duckweed, rushes, water spinaches, lilies, shrimp, fish and other seafood crops. In urban areas, aquaculture is often waste-water-based and frequently shares water space with recreation uses.

Aqua-terra farming—A system of agriculture in which water crops and land crops support each other. Land crops may include trees, vegetables, livestock and flowers; in the water, poultry, fish, vegetables and crayfish may be grown.

Community kitchen—A community-based organization that includes communal food purchase and preparation. Some community kitchens have small farms.

Companion cropping—Growing compatible crops, with one protecting the other from attacks by insects or diseases (for example, marigolds with cabbage).

Farming system—The various crop production methods used on a single farm or a system of agriculture—such as greenhouse floriculture or roadside vegetable horticulture—that has a distinct set of farming practices. This volume uses the second meaning. Aqua-terra farming (defined above) is an example of a complex farming system.

Food-shed—A basic concept for defining urban agriculture that is derived from the idea of the watershed. Maps are drawn that show the flow of a particular food from production to consumer (see chapter 1).

Fungible income—In urban agriculture, production of food as a substitute for buying it, which frees part of the household income for paying for services and other goods (see chapter 1).

Horticulture—All crops cultivated on land, including vegetables, berries and trees. Ornamental horticulture and forestry are special types. Horticulture sometimes refers more narrowly to vegetable production.

Intercropping—Growing two crops together at the same time, such as a short-season tomato and a long-season sugarcane.

Layering—Growing trees over bushes over ground-level vegetables.

Microlivestock—Small livestock including guinea pigs, guinea fowl, rabbits, pigeons, chickens, ducks, pigs and goats. In this volume, the term is used primarily in the narrower sense to mean small domesticated animals, as distinguished from poultry. Microlivestock is generally the type of livestock most suitable for small farmers in urban agriculture.

Multicropping—Refers broadly to growing a number of crops at one site, whether mixed together or not. Home gardens typically use multicropping.

Mycoculture—The systematic production of mushrooms.

Outgrower—A contract producer. Typically, a firm contracts with an outgrower for a specified production by a specified date.

Peri-urban area—An area at the fringe of the city that is in the process of converting from rural to urban land uses. The size of the peri-urban area is defined more by transportation infrastructure and uses of the land than by either city population size or distance from the centre. Thus accessibility is a key factor determining the extent of the peri-urban area. These zones are a common locus of urban agriculture.

Pisciculture—Fish production, a branch of aquaculture.

Productive landscape—A concept in which the open spaces are perceived as potentially productive rather than simply recreational or aesthetic (see chapter 1).

Throughput—The balance between inputs and outputs that flow through a community. Urban agriculture reduces a city's throughput by reusing its waste to produce food and fuel (see chapter 1).

Usufruct—The legal right to “use and enjoy” (the Latin root of the word) something that belongs to another. In urban agriculture, a usufruct permits a farmer to exploit land or water owned by another (see chapter 1).

Zero-grazing—Maintaining and feeding livestock within an enclosed area (for example, a stable or pigsty).

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Countries cited in figures, cases and photos

This list should prove useful to readers who wish to glean from this volume information about urban agriculture in a particular country or region. “F” refers to a figure, “C” to a case and “P” to a photo.

AFRICA

Côte d’Ivoire: P/3.7, P/5.8, P/7.3, P/9.6
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ASIA AND PACIFIC

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 Indonesia: P/2.2, C/2.4, C/7.4, P/9.2
 Lebanon: F/4.5, C/7.9, P/7.14
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 Philippines: C/3.4, P/4.9, C/4.10, P/4.10, C/9.5
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 Sri Lanka: C/7.5
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Italy: P/7.11

Netherlands: C/2.7

Russia: C/5.4

United States: P/3.8, P/5.3

Cities and towns visited by The Urban Agriculture Network, 1991–95

The Urban Agriculture Network visited 18 developing countries between fall 1991 and spring 1992 during four study trips funded by UNDP. During the preparation of this report, the authors also visited cities in 12 additional countries for conferences, interviews or field observations; these cities are denoted with an asterisk (*). The towns and cities visited included a wide range of cultures, economies and climates.

EAST AND SOUTH ASIA

India

Bhatpara
Burdwan
Calcutta
New Delhi

Indonesia

Bandung
Bogor
Jakarta

Philippines

Cavite
Los Baños
Manila

Taiwan

Kaohsiung
Taichung
Tainan
Taipei

Thailand

Bangkok
Samut Sakhon

MIDDLE EAST

Egypt

Cairo*

Lebanon

Beirut*

EUROPE

France

Amiens*
Paris*

Germany

Berlin*
Frankfurt am Main
Freiburg im Breisgau*
Leipzig*
Zschortau*

Italy

Rome*

Netherlands

Amers Foort*
Amsterdam*

United Kingdom

Chatham*
London*
Manchester*

SUB-SAHARAN AFRICA

Côte d'Ivoire

Abidjan
Agboville
Bingerville*
Dabou
Danane*
Yamoussoukrou*

Eritrea

Asmara*
Dubarwa*
Keren*

Kenya

Nairobi
Naivasha
Ngong

Senegal

Dakar
Louga
Saint-Louis
Thiès

Tanzania

Arusha*
Bagamoyo
Dar es Salaam
Dodoma*
Lushoto*
Mehru*
Morogoro

Uganda

Kampala*

Zambia

Lusaka

SOUTH AMERICA**Argentina**

Buenos Aires
Lomas de Zamora
San Isidro

Bolivia

El Alto*
La Paz*

Brazil

Curitiba
Rio Branco do Sul
Rio de Janeiro

Chile

Maipú
Santiago

Colombia

Bogotá
Cali*
Medellín*
Villa de Leyva*
Zipaquirá

Peru

Chosica
Lima
Villa El Salvador

**CENTRAL AMERICA
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Port-au-Prince*

Mexico

Coyoacan
Culhuacan
Mexico City

Nicaragua

Managua
Nagarotte

Panama

Colón
La Chorrera
Panama City

NORTH AMERICA**Canada**

Ottawa*

United States

Baltimore*
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New York*
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Selected resource people

The individuals listed here are among the most knowledgeable experts in various aspects of urban agriculture. Many were called upon during the course of this study. The specialties of individuals who focus on a particular area of urban agriculture are shown in brackets. Where no specialty is listed, the individual is an expert in urban agriculture in his or her country of residence.

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Selected readings

The Urban Agriculture Network has assembled the world's largest library of materials on urban agriculture. The titles listed here are a cross-section of this collection.

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Response form

Name:

Organization:

Address:

City and Country:

Contact No. (phone, fax and e-mail):

For purposes of this response form, urban agriculture (UA) activities include vegetables, fruit, fish, fuel, poultry, livestock and forestry in urban and peri-urban areas.

- | | YES | NO | COMMENT |
|--|-----|----|---------|
| 1. Is there UA in your city ? | | | |
| 2. Is there UA at its edge (in peri-urban areas or suburbs)? | | | |
| 3. Who are the urban farmers in your city and suburbs? | | | |
| Householders | | | |
| Institutions | | | |
| Entrepreneurs (business) | | | |
| Low-income residents | | | |

4. Does your city regulate UA?
5. Are there support programmes for UA in your city?
6. Is research on UA under way?
7. Does UA cause problems in your city?
8. Does UA contribute benefits to your city?
9. What UA activities have you undertaken in the past?
10. In what UA activities are you currently involved?
11. What UA activities do you expect to undertake in the future?
12. What use will you make of this book?
13. What in your view does this book lack?
14. Would you like to join The Urban Agriculture Network or a regional UA network?



All respondents will receive a reply. Thanks for your help!

Please return this completed form to:

Jac Smit, Annu Ratta and Joe Nasr

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