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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Urban agriculture
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

Foreword
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 Children's Fund
USAID United States Agency for International Development
USDA United States Department of Agriculture
WHO World Health Organization (United Nations)
Part one

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 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 under-valued. 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.²

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 preparation and preproduction 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. Barters, 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 practice 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,
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. 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. 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.

The food supply system can be viewed as a series of food-shed overlays of varying diameter, shape and direction from the city,
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%. 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 times are 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.
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. 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 de-centralizing 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.


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.


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

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>World population actively engaged in urban agriculture (many for consumption)</td>
<td>800 million</td>
</tr>
<tr>
<td>Farmers producing for the market (many part-time)</td>
<td>200 million</td>
</tr>
<tr>
<td>World employment in production and processing (full-time job equivalents)</td>
<td>150 million</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preponderant range of data</th>
<th>Global general significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants (share of urban families)</td>
<td>15% to 70%</td>
</tr>
<tr>
<td>Production (vegetables, eggs, meat and fish)</td>
<td>10% to 90% of consumption</td>
</tr>
<tr>
<td>Land use (land in agricultural use)</td>
<td>20% to 60% of urban area</td>
</tr>
</tbody>
</table>

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. Table 2.2 presents additional evidence of the extent and scale of the urban agriculture industry today.

Table 2.2 Selected data on the extent of urban agriculture

<table>
<thead>
<tr>
<th>Country</th>
<th>Extent of urban agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRICA</td>
<td></td>
</tr>
<tr>
<td>Mali</td>
<td>Barnako is self-sufficient in horticultural products, and some products are shipped outside the metropolitan area for consumption.</td>
</tr>
<tr>
<td>Uganda</td>
<td>In Kampala, 70% of poultry needs (meat and eggs) are produced inside the city.</td>
</tr>
<tr>
<td>Zambia</td>
<td>In Lusaka, subsistence food production accounts for 33% of the total consumption by squatters.</td>
</tr>
<tr>
<td>ASIA</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>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.</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Vegetables sufficient to meet 45% of local demand are produced on 3–6% of total land area.</td>
</tr>
<tr>
<td>Indonesia</td>
<td>In Jakarta, almost 20% of the food consumed by squatters is self-produced.</td>
</tr>
<tr>
<td>Nepal</td>
<td>In Kathmandu, 37% of food producers surveyed met their household plant food needs and 11% met their animal food needs.</td>
</tr>
<tr>
<td>Singapore</td>
<td>Eighty percent of the poultry and 25% of the vegetables consumed are produced within the city.</td>
</tr>
</tbody>
</table>

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 practiced today.
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.
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 far away as London. Furthermore, as "the maraîchers 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 bio-intensive system is now being copied worldwide, with the help especially of Californian researchers. 

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. 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.

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 both urban and rural 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 intensive 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 multi-storey 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 unsuited for 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 favor 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 adopted 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 stream sides 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. 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.

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.

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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.
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 bio-intensive 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 Panama 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, Arborización 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, CEPI, 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. CEPI 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.

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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. 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 centers, 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.

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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. 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.

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.

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%. 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 a 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.

Notes

4. Fo Hsing Lin, director, Kaohsiung District Agricultural Improvement Station, Ping Tung City, Taiwan (province of China), personal communication, 1992.
5. Anuchit Sodsathit, director, Department of Policy and Planning, Bangkok Metropolitan Administration, personal communication, 1992.
9. "One of the most accepted theories to explain Machu Picchu says that it was a temple or shrine dedicated specifically to agriculture, with several functions: (a) to connect agriculture with Viracocha (supreme god); (b) to serve as an agriculture research station; (c) as a seed production and germosperm bank; and (d) as a training centre for terrace agriculture." Jorge Zapp, personal correspondence, 1994.
10. The most important promoter of bio-intensive gardening is John Jeavons, whose How to Grow More Vegetables (Berkeley, Calif.: Ten Speed Press) has sold more than 300,000 copies worldwide since the first edition appeared in 1974.
18. For a survey of the case of Tokyo, see Yorifusa Ishida, "Agricultural Land Use in the Urbanized Area of Tokyo: History of Urban Agriculture in Tokyo, 1850s–1990s", presented at the Sixth International Planning History Conference, Hong Kong, 1994. Professor Ishida has also written a book (in Japanese) on urban agriculture and land use planning.