Urban Agriculture

Food, Jobs and Sustainable Cities

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Chapter 2
Urban Agriculture Yesterday and Today

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Urban Agriculture Yesterday and Today

Urban agriculture throughout the world is transforming itself in response to political, economic, environmental, and technological changes. Its emerging role in today's urbanizing world is just beginning to be understood and quantified. While data remain limited, global estimates of the number of people involved in various urban agricultural activities can be attempted based on projections from surveys and observations (Table 2.1). The percentage of urban families engaged in agriculture varies from fewer than 10 percent in some large cities in North America to as many as 80 percent in some smaller Siberian and other Asian cities.

During the 1980s and 1990s, the importance of urban agriculture accelerated dramatically throughout the world. Surveys in Moscow in 1970 and 1991 indicated a shift from 20 percent to 65 percent of families engaged in agriculture.[1] Surveys in Dar es

Table 2.1 Global estimates of the level of urban agricultural activity (based on 1993 data)

Parameter	Population
Actively engaged urban farmers (worldwide)	800,000,000
Farmers producing for markets in the world	200,000,000
Jobs in production and processing (worldwide)	150,000,000[1]

1. Actual employment, not job equivalents

Parameter	Range of data and significance
Urban farmers (share of urban families)	15–70% of families (about one-third of urban families)
Production (vegetables, eggs, meat, fish)	10–90% of consumption (about one-third of consumption)
Land in agricultural use	20–60% of urban area (more that one-third of urban regions)

Source: Estimates by The Urban Agriculture Network based on the author's (Jac Smit) experience and observations and on extrapolations from statistics from various official censuses and professional surveys. 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.

Salaam, Tanzania in 1967 and 1991 showed an increase of family agriculture from 18 percent to 67 percent.[2] Reports from Kinshasa, Kampala, and Maputo speak of massive shifts of urban land from open space, and from institutional and transportation use to agricultural production. Roadsides, portions of streets, electrical utility rights-of-way, golf courses, hospital grounds, and airport land beyond the runway were used to grow food for the poor. 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), with a primarily urban population, reports that more than half of its families belong to farmers' associations.[4] In greater Bangkok, Thailand, a government-sponsored land use survey found that 60 percent of the land was farmed.[5]

In the United States, more than one-third of the dollar value of agricultural produce is produced within urban metropolitan areas.[6] An upward trend was identified by an agricultural census conducted twice each decade. As city populations and urban area increase, agricultural production also increases within metropolitan and adjacent areas. From 1980 to 1996, this increase was 30-40 percent.

Cairo reports 80,000 livestock within the city.[7] Low-income 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 extended metropolitan region of Shanghai is largely self-sufficient in vegetable and small-livestock production — a remarkable accomplishment considering the high per capita level of vegetable consumption.

The urban area used for agriculture may be greatly underestimated. In the Dar es Salaam district in Tanzania, for example, although the majority of families farm, only 10 percent of the land farmed is officially recorded by the Regional Agriculture Office.[8] Table 2.2 presents additional evidence of the extent and scale of the urban agriculture industry today.

Brief History of Urban Agriculture

Urban agriculture is a recent phenomenon in only a few places. Throughout the world, there are long traditions of farming intensively within and at the edge of cities. Each tradition is deeply rooted in local concepts of city and community, and in local societal and cultural practices. This section briefly reviews the beginnings of urban agriculture and how it became what it is today.

The present mix of farming systems in cities was shaped primarily by eight factors:

Continuity of historical practices. There are numerous instances of urban agricultural practices with roots that date back decades or centuries but have evolved to accommodate contemporary conditions — allotment gardens in Europe that were invented in the second half of the 19th century, vegetable patches in African colonial cities with their roots in ancient communal practices, the centuries-old Chinese system of reusing the night soil of cities to fertilize nearby farms, or Mexico City's *chinampas,* which represent a specific farming system predating the arrival of Columbus.

Table 2.2 Selected data on the extent of urban agriculture

Country	Extent of urban agriculture
Africa	
Mali	*Bamako* is self-sufficient in horticulture products and some products are shipped outside the metropolitan area for consumption.
Uganda	In *Kampala*, 70 percent of poultry needs (meat and eggs) are produced inside the city.
Zambia	In *Lusaka*, subsistence food production accounts for 33 percent of the total consumption by squatters.
Asia	
China	In the 1980s, over 90 percent of vegetable demand and over half of meat and poultry demand in China's 18 largest cities was met through produce grown in urban provinces.
Indonesia	In *Jakarta*, almost 20 percent of the food consumed by squatters is self-produced.
Nepal	In *Kathmandu*, 37 percent of food producers surveyed met their household plant food needs and 11 percent met animal food needs.
Singapore	Eighty percent of the poultry and 25 percent of the vegetables consumed are produced within the city.
Europe	
Romania	With new government policies and programs, from 1992 to 1998, urban production increased from 14 to 26 percent of all agricultural production.
Americas	
Cuba	From 1992 to 2000, urban food production increased by 300 percent and children are eating four times as many vegetables as they were a decade ago.
USA	Thirty percent of agricultural products in the country are produced within metropolitan areas.

Source: Data compiled by The Urban Agriculture Network from various sources.

Nature of plant and animal domestication and its relationship to people. Urban agriculture has evolved a mix of plants and animals that is somewhat distinct from rural agriculture for several reasons — livestock, fish, and horticultural crops need to be tough to survive a relatively hostile urban environment, the high value of land necessitates growing higher-value products, and the urban market demands diverse products that urban farmers often focus on.

Conception and management of natural and man-made environments. Some societies have evolved technology and management systems that include agriculture as an urban activity, but others have separated the settled and the sown. This difference in approach typically reflects varying attitudes to the way natural and man-made environments relate to each other, and characteristically has cultural roots.

Industrial agriculture revolution. In many parts of the world, beginning in the late 19th century, machines replaced manual labor in many forms of agriculture, and units of production, processing, and marketing became larger. Urban agriculture has responded to this rural-dominated trend by concentrating on niche markets, barter trade and currency trade, reuse of waste, and household and community organization to foster food security.

Global information revolution. The information revolution is spreading the know-how of urban food production across national and cultural borders. It is also enabling new forms of marketing particularly suited to cities because of their greater connectivity.

Rapid post-World War II urbanization. Urbanization has advanced more rapidly than population, economies, or farm-to-market and other infrastructure in the majority of countries. Therefore, the burden of feeding cities increasingly falls on city folk themselves. On every continent, the relative shortage of land has generated more intensive means of production and a lengthening of growing seasons, from rabbit hutches on the veranda to greenhouses at the electrical power plant.

Settlement patterns resulting from contemporary urbanization. The nature of human settlements — especially urban settlements — has been transmuted in the past half century in particular. The emergence of the megalopolis for the first time is perhaps most remarkable, but little noted is the amount of unbuilt (and cultivated) land that lies in the interstices and along the edges of the megalopolis. More generally, recent urban development has been — despite impressions to the contrary — increasingly low in density, affording ever greater opportunities for urban agriculture within urban settlements.

Great expansion of low-income segments of the urban population. Poverty has become an increasingly urban phenomenon at the end of the 20th century. The first concern of the urban poor is food security, and through their resourcefulness, they have reinvented agriculture to fit the new post-industrial city.

The first three factors give historical roots to urban agriculture, and help to explain both continuities in some instances, and changed practices in others. The last five factors are mainly contemporary developments — rapid urbanization has meant that the number of urban residents, particularly the urban poor who had to find ways to sustain themselves, has greatly expanded the scale of urban agriculture. This has been accompanied by new ways to produce for growing populations, thus the legacy of ancient and recent historical developments can be seen in the way urban agriculture is practiced today.

Food insecurity has always haunted cities and towns. At times it would be well-controlled, at other times it would strike more or less significant portions of the population. Food security was managed, partly through uncoordinated individual actions, and partly through planned public and private interventions. It is difficult to know

whether what we call urban agriculture was developed by the first urban settlers in a systematic way to feed their cities, or involved incremental modification of food production as urban concentrations took form. Both are likely.

At all times, urban agriculture has played some role in ensuring a food supply for urban residents. In all parts of the world, ancient civilizations developed urban agriculture systems, devising many innovative ways to produce food and manage land, water, and other resources efficiently. Some might argue that intensive food production is what allowed societies to create cities and civilizations. Examples can be found in Ghana, China (Fig. 2.1), India, Iraq, Java, Pakistan, Guatemala, Mexico, Myanmar, and Peru. The intensive production of perishables, small livestock, fish, and poultry was essential to city life (Fig. 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.

The oasis towns of Iran are an early example of urban agriculture. The ancient Persians invented *qanats*, underground aqueducts that carried dew-generated water and rain water from the hills to the town where it was used for irrigation and other purposes. Cattle were grazed in the desert, but were penned part of the year in town, while fruits and vegetables were also grown in town. This system conserved water by keeping it protected from the sun, and combined carefully managed water use and composted urban waste.[9]

The towns and cities of early civilizations on Java and in the Indus valley show traces of high-intensity raised-bed farming systems. The Javanese aqua-terra system, combining multicrop systems for water and soil farming, has to some extent survived, as have the Aztec *chinampas* in Mexico and the comparable *hortillonages* in France. Similar systems are being studied in Ghana and China.

Among the most important historic cases to be 'rediscovered' are those in Latin America. Aztec, Mayan, and Incan cities not only were self-sufficient in perishable fruits and vegetables from inside their territory plus nearby rural areas, but also raised some grains within a confined hinterland (Case 2.1).

Case 2.1 Agricultural landscapes in the ancient Maya cities of present-day Belize

Research into Mayan urban landscapes is in its infancy, so much remains unknown, but the tropical urban environment almost certainly involved trees and tree crops on a large scale. Sites such as Caracol and Lamanai in Belize provide some indications of the character of food production in ancient Mayan cities.

Caracol, for example, was estimated to have had a population density of over 1,000 people per square kilometer (with 115,000–150,000 total population). Its urban landscape comprised dense clusters of buildings interspersed with agricultural terraces, a pattern that investigators believe represents a focus on urban self-sufficiency. Terraces and reservoirs were located throughout the city. Archaeologists do not yet know what was grown in terrace soils because pollen and phytoliths were not preserved, but comparative agricultural studies suggest that continuous cultivation involved intercropping as well as multicropping of a wide variety, including

maize, beans, vegetables, tree crops, palm for roofing, and cotton. The proximity of terraces to housing groups also suggests the use of night soils and kitchen waste.

Lamanai has not been intensively surveyed for terrace features, but immediately north of the urban core lies an area entirely given over to raised field agriculture. This site was cultivated for over two millenia, from 1500 B.C. until the British colonial period. Raised fields were built up of mud drawn from constructed canals linked to the lake, and the presence of such fields leaves little doubt that the city was in the business of feeding its people.

Contact: Elizabeth Graham (see Appendix F for complete address).

Macchu Picchu, the 'lost city' of the Inca, appears to have been self-sufficient in food within walking distance.[10] The main city also had a suburb a few miles away that served principally for intensive agriculture. Land-form creation, water management, and tree plantings stretched production to two crops a year at altitudes that had frost much of the year.

In addition to irrigation technology, ancient farmers had sophisticated methods to improve soil and control insects. Manuals describe specific uses for human and animal offal and mixtures with other waste materials. Wastewater from cities flowed into tanks, and from tanks to fields for irrigation.

An important difference in urban agriculture between the Old World and the Americas lies in the relationship between people and trees. Food production in the Old World was linked to relationships that developed between people and grazing animals, which gave primacy to treeless landscapes. Where grazing animals were not among a civilization's domesticates, as in the case of the Mayan lowlands in Central America, the 'idea' of cities and food production in cities, was necessarily different. The result was that urban agriculture in the American tropics took on a radically different character.[11] For a number of reasons (including reliance on cattle and sheep), the use of these systems was disrupted by Spanish conquerors.[12] However, the introduction of new crops increased the productivity per unit of space of some systems.

In several sites in Peru, Guatemala, and Mexico, agriculturists, with the help of archeologists, are reactivating the ancient systems and learning lessons about sustainable, intensive agriculture that are applicable today.[13] In one case, production levels support two families on 1 acre (0.40 hectare). In another, a revival of ancient terrace techniques was remarkably successful. One of the most important lessons is the use of aqua-terra systems in which water and land crops are produced in symbiosis (Case 4.6). These systems are particularly relevant to urban agriculture because they are efficient in areas of poor soil, steep slopes, and wetlands. They depend for their productivity on waste management.

In many ancient systems, the vagaries of climate were tempered through such techniques as irrigating 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 Macchu Picchu, as in the Mexican *chinampas*, 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.

For centuries, and in different parts of the world, cultivation and animal husbandry inside and outside city walls were standard practices. 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 both rural and urban fields. 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 Fig. 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 percent 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 carbon dioxide released from fermenting manure, shelter provided by 2-meter-high walls surrounding the properties, glass-covered frames and bell-shaped glass cloches (covering a quarter of the total cultivated area), and straw mats used to cover crops during severe weather.

Marais cultivation was highly labor-intensive. It used heavy dressings of stable manure, equivalent to an annual application approximately 30 centimeters 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.

Gathering inputs, production, and sales were intricately connected in the farming household. The farming couple would typically leave their farm in the middle of the night in order to be at the Halles (main market) at 4 a.m. The woman would generally sell the produce while the man would gather waste from the street and slaughterhouses to return to the farm.

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

From the 1850s until World War I, the cultivated area was fairly constant (approximately 1,400 hectares), as was the average size of a holding (0.75 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, but three factors led to its rapid decline in the early 1900s — 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 system continued on a limited scale in the Paris suburbs, specifically in areas adjoining the main wastewater treatment plant downstream along the Seine river. Fields irrigated by the treated water were cultivated until the end of the 1990s, when a contamination scare brought the system to a halt within a short time.

The marais cultivation system remains one of the most productive ever documented. This biointensive system is now being copied worldwide, with the help of California researchers, among others.[14]

Contact: Professor André Fleury (see Appendix F for complete address).

Some colonial cities incorporated the principle of using urban waste to enrich 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.[15] 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' and the 'city healthful'. In most developing countries, modern agricultural systems have replaced traditional ones.

Industrial-era 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 World War I:

> 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.[16]

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 and dispose of increasing volumes of wastes from one location to another within the urban ecosystem or outside, 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 growth 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 grew in parallel with the urban population, accelerated by political and economic instability in too many places. In response, urban agriculture became increasingly common in an ever-growing number of countries. Initially, urban residents undertook urban farming, but it was only later that urban and agricultural researchers and policymakers took notice of its significance.

With this rediscovery has come an exploration of past practices. A review of urban agriculture as it is practiced worldwide makes clear the debt that present-day urban agriculture owes to the past. Indeed, much is still to be learned from the food production systems of earlier civilizations and their related land use and infrastructure management systems. This knowledge would not only widen the choice of appropriate practices available in the South, but would also enable a South-North knowledge flow to complement the North-South flow that has dominated agricultural exchanges over the past couple of centuries. In most developing countries in the 1990s, there are two complementary agricultural systems — modern and traditional. In urban areas, the traditional system is prevalent and is making advances in both technology and scale of production.

Southern and Eastern Asia and the Pacific

Asia has the most diverse and largest number of modern intensive farming systems. Urban farms in Asia provide vegetables, poultry, mushrooms, fish, seaweed, swine, fruit, medicinal herbs, and wood for furniture. These 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. Urban agriculture is still accepted in most Asian countries as a normal urban function and land use. A few countries are discussed here for illustration.

Before railroads, the internal combustion engine, and electrified cold storage, perishable foods had to be produced close to markets. Nineteenth-century China, with thousands of large and small towns, excelled at urban agriculture. In the 1960s, China overhauled its land-use regulations and developed a specific urban development policy and strategy that included self-reliance in vegetables and protein for its established large cities and growing new towns (Case 6.2). This strategy included defining broad urban regions, land-use plans, and waste recycling programs to support urban agriculture. These policies continued into the 1990s and beyond, although they are suffering from increasing problems today (Case 9.3).[17]

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 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 World War II.

It is estimated that until the 1980s, Hong Kong, the densest large city in the world, still produced 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.[18] Floats that carry fish cages in the bays also support biointensive vegetable beds, and duck and chicken wastes are used as food for fish and fertilizer for vegetables.[19] Meanwhile, Singapore has been increasingly effective at producing large quantities of food in a small, dense area — after a policy change in the 1980s, production has risen. Singapore's hydroponic technology leads the world (see Case 9.4).

An NGO in Manila, the Urban Food Foundation, and researchers at the University of the Philippines are promoting fruit, vegetable, and livestock production, primarily by small farmers (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 launch fishing enterprises. MEREC (Managing Energy and Resources Efficient Cities), a USAID project in the 1980s, helped an urban agriculture program in Tacloban (Philippines) that has become a model.[20]

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. The 1972 Karachi Urban Regional Plan, helped by the UN Office of Technical Cooperation, included protection and promotion of urban agriculture in and near Karachi, particularly related to the informal residential areas. This has had some small benefits for the city. [21]

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.[22] Indonesia also has a significant urban agriculture industry that has benefited from government support (Case 2.3).

Case 2.3 Urban agriculture in Indonesia

Indonesia, particularly Java, has an urban agriculture tradition as old as that in China. Both China and Java developed aqua-terra farming systems centuries ago in which land and water crops are farmed in former wetlands. 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 20-40 crops, and

yields are highest within urban areas. Poultry has developed into a well-organized subsector (Case 7.4). Street food that is available throughout towns and cities at all hours is largely produced and processed within settlements.

With support from 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.

In 1992, the Ministry of Research and Technology (which is responsible for long-range planning) called for Java, the densest and most urbanized island, to shift from primarily grain production to higher-yielding crops, beginning with horticulture. Recent studies there have found that intensive, urban-type cultivation produces 3-6 times as much nutrition as multicrop rice production. The ministry has also supported research into small-scale composting to improve soil and improved, sustained crop production.

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 percent of the city area). Land forms and soil conditions make most of this area ill-suited to built-up uses.

Food production took on an entirely new dimension with the economic collapse that occurred in the region in the latter part of the 1990s. It became an even greater necessity to mitigate the fall in purchasing power and great increase in unemployment. As a result, much idle land was invaded and dug up by gardeners in cities and towns all over the country, which helped people to absorb some of the shock, particularly the poor

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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 to 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 includes urban agriculture in the regular census, and the Japanese publish numerous papers on the subject, although few have been translated.[23] Special seeds, crop types, and tools have evolved to serve the small plots of urban farmers, and the food marketing system is especially suited to them. Particularly noteworthy are the consumer-supported agriculture (CSA) groups to which millions of Japanese consumers belong — they pay a 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'.[24]

Australia and New Zealand, historically known for their wide-open spaces and low population density, have rapidly expanding urban agriculture sectors. The Ministry of Agriculture in Australia finds that one in three urban families is raising food or ornamental crops. In Auckland, New Zealand, a small-scale hydroponic farm guarantees delivery to six supermarkets and 36 restaurants within 45 minutes (see Case 3.3).

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 trees on streets, which provide vitamins to the city's diet while saving on maintenance costs.[25]

Some Asian farming systems have been introduced to cities throughout the world. Japanese immigrants brought their techniques to Brazil decades ago, and 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 programs to Central America and East Africa.

Middle East and North Africa

The Middle East and North Africa have some of the most ancient cities in the world, penetrated by productive gardens and surrounded by agricultural belts. They are cradles to urbanization as well as to agriculture. Intricate links between urban settlements and food production have long been known and documented, and carry on today. [26] They ranged from the revived system of *qanat* irrigating some Iranian towns, to Istanbul's horticulture along its ancient city walls,[27] to the *hawakir* (market gardens) of Syria's central cities,[28] to the massive oasis in Damascus (the *ghouta*),[29] to vegetables grown around Beirut[30] and citrus around Tripoli and along the coast of Israel, down to Sanaa's famous enclosed gardens.[31] Crossing into North Africa, the role of the Nile delta in feeding Cairo has been established for over a millenium; less well known are the agricultural zones that surround the main cities of the Maghreb.[32]

The Middle East and North Africa have among the highest levels of urbanization in the developing world, meaning that urban agriculture may have a more powerful role here than in most other regions. Yet of all the main regions of the globe, this may be the one where urban agriculture has been the least recognized, although in recent years this lack of visibility is finally receding. Urban food systems have started to capture some attention, and a few noteworthy studies of urban food production were recently launched. In addition to technical experiments in water-saving agriculture for which Israel and some other countries have been reputed, some urban regions have pioneered comprehensive conferences (Case 2.4), multidisciplinary research programs (Beirut), and city-wide censuses (Amman) of urban agriculture in the last years of the 1990s.

Case 2.4 Urban agriculture in the Gaza strip

While political motivations behind agriculture, water, and land policies can be found everywhere across the globe, none perhaps affect urban agriculture more directly than in the West Bank, and especially the Gaza Strip. Consider the 'politics of planting' in Israeli- and Palestinian-controlled territories, wherein the ability to cultivate is central to control over land. This bears particularly on those lands in and around established cities, because that is where control of territory is most vital and complex, affecting everyone from backyard gardeners to olive growers.

The Gaza Strip (less than 50 km long, just a few kilometers wide) is one of the most densely populated zones in the world. This entire strip could be labeled as single urban area without hinterland, yet 20 percent of the employed labor force works in the agriculture sector. Beyond this, it is unknown how many families are active in informal agriculture, although this appears to be an even higher percentage.

All this takes place in circumstances that may appear to be highly unfavorable to farming — high population density; great pressure on the land due to an elevated fertility rate; severe water shortages due to arid conditions because of a fast-growing population and Israeli settlements (which lead to overextraction from the water table by competing users); significant economic difficulties that force much labor to cross into Israel for work; and uncertainty about the ability to export products of market gardening due to frequent closures of the border. Remarkably, it is all these factors that have allowed (even forced) agricultural activity in the Gaza Strip to flourish.

The great level of food insecurity has meant that partial self-reliance on food production has been imperative for many households; the more difficult the period, the more products for which the Gaza Strip had to be self-sufficient. Because of limited employment opportunities, farming has been one of the few reliable economic sectors, with a constant demand for its products. When the export market gets temporarily blocked, the products get diverted to the local market. The various technical challenges, particularly water deficiency, have forced greater adaptability and inventiveness by farmers, such as the increasing use of gray water for irrigation.

The difficulties have of course come with costs. Application of chemicals is sometimes intensive to maximize production, and the lack of water is leading to use of untreated wastewater ponds. However, there seems to be a general awareness of the problems among the ordinary farmers as well as the pertinent institutions, leading to an openness toward the search for improvements — and an acknowledgement of the importance of urban agriculture. To that end, a workshop on urban agriculture was held in Gaza in 1998, the first of its kind in an Arab country. This has since led to the formation of the Gaza Urban Agriculture Committee, to encourage and support urban agricultural activities.

Contacts: Ahmed Sourani and Riyad Juninah (see Appendix F for complete addresses).

The Middle East and North Africa have no monopoly on arid and semi-arid climates. With some exceptions, however, water is a more vital consideration for urban agriculture across the vast majority of cities in this entire sizable region than it is in the other regions. In over three-fourth of this region, evaporation exceeds precipitation. It is not just a question of water quantify but also of timing — the seasonality of precipitation around the Mediterranean basin is a determining factor in all farming practices, and particularly in urban farming practices, especially for irrigation and climate modification.

The predominance of aridity as a defining feature of Middle Eastern urban agriculture has consequences for the types of crops that are grown. A number of crops are particularly characteristic of the Mediterranean basin or of the more desertic Arabian and Saharan subregions. Of these crops, certain ones (vegetables such as artichokes, fruit trees such as grapevines, and countless herbs) are particularly suited to cultivation in smaller urban spaces. The reasons include greater productivity on limited land; higher potential for the adoption of intensive, commercialized techniques; or less susceptibility to contamination from polluted soil, air, or irrigation water. Numerous fruit trees across

the region, such as figs, dates, mulberries, and olives, are also used as ornamental trees, giving them a dual function in urban areas.

The prevalent arid and semi-arid conditions have endowed this region with a special role as an experimental field and incubator for irrigation technology. This role is already being fulfilled — development of techniques for controlled watering in both greenhouses and outdoors in Israel and Jordan; desalination of water and the exploration of certain crops on the Arabian Peninsula; and experiments in the recycling of used water in Israel, Tunisia, and Morocco. Indeed, the reuse of treated wastewater for irrigation may be more vital in the Middle East and North Africa than elsewhere because it can free up scarce water for other purposes.

Despite such efforts, arid climate technologies are far from being fully developed and made broadly accessible and operational across the eastern and southern Mediterranean basin. Even Israel, a world leader in water-saving techniques, diverts urban wastewater to more distant agricultural settlements where it is used to irrigate low-intensity fodder crops and orchards.[33] The potential for wastewater reuse is also greatly restricted by religious limitations. Some Muslim clerics do not approve of such a use, although unlike consuming pork, prohibition appears not to be as clear-cut and is subject to varying religious interpretations.

Both Islam and Judaism have special requirements for processing agricultural products, particularly livestock. This means that there are special processing practices (halal, kosher) throughout the Middle East and North Africa that may influence urban agricultural activities, their locations within urban areas, the produce raised, and the uses to which the products are put. Similarly, religious festivities in this region necessitate the rearing of livestock (mostly lamb) for sacrifice (primarily but not exclusively by Muslims). This is often undertaken in the midst of urban areas, particularly in poorer neighborhoods; importing livestock from the countryside for this purpose accounts for only a portion of the needs of urban areas. Thus, animals found on urban streets, lots, or backyards in Middle Eastern and North African cities may have religious implications in addition to those of the household and community food supply.

Certain land tenure characteristics are particular to either the Middle East in general or to certain countries and subregions within it. An especially notable institution is that of the *waqf*, land owned by any of the various religious communities or foundations. Such land holdings were widespread under the Ottomans and remain extensive today; their presence makes religious groups a key player in agriculture, urban as well as rural. In Jordan and other countries, anyone has the right to cultivate (even without requesting permission from the owner) any land that is left unused. The land owner must wait until the end of the growing season to reclaim his land. Grazing of large livestock is similarly customary. These usufructuary practices date back at least to Ottoman times.

With the constant presence of strife in different corners of the Middle East and North Africa, there is an exceptionally high concentration of long-term refugees. Policies for the settlement of nomads are also common across the region. Both of these realities entail settlements that are quasi-urban in nature, even if they are not within cities proper. Yet the presence of agriculture here remains mostly potential rather than actual — farming in resettlement areas could indeed be greatly expanded if favorable policies were instituted.

Several countries (Iran, Iraq, the Palestinian territories, Libya, Algeria) are more or less closed off to the outside world, pressing many of their urban citizens into farming.

While some general traits can be found across the Middle East and North Africa, this region is quite heterogeneous, including strong contrasts in climate, topography, and other physical features; considerable variations in urbanization and population; as well as sharp economic differences. The density and sprawl of urban areas in Lebanon are in contrast to cities in the Arabic Gulf states that grew from oasis settlements or were recently planted in the vast expanses of the desert. Egypt is yet another variant as urbanization occurs there simultaneously in valuable, fertile farmlands and in the adjacent desert. Each of these urbanization patterns has clear consequences for the place of urban agriculture.

Different distinguishing features of urban farming can be found in various principal cities in the Middle East and North Africa. The housing stock in both Baghdad and Amman contains a significant portion of detached housing, which has enabled the common presence of household gardens that combine recreational and productive uses (especially fruit trees).[34] The growth of Irbid, Jordan is resulting in new olive plantations as long-term investments, replacing the low-intensity grain production that is traditional to the expansive Houran plain where it sits. The prevalence of livestock raising in Egyptian cities (16 percent of Cairo households by one estimate)[35] is not known in most other Arab cities. Meanwhile, in the United Arab Emirates, 90 percent of the country's dairy needs are met through local production of milk centered around the town of Al-Ain, while market gardeners not only meet the local need for many fruits and vegetables, but even supply some fruits to Europe.[36]

Sub-Saharan Africa

Urban agriculture in Africa presents a contradiction — it has a relatively long tradition and is widely practiced, yet in most African countries urban agriculture has been undervalued and resisted by generations of public officials. This attitude has only recently begun to change as leaders realize the potential of urban agriculture to alleviate the growing hunger, economic, and environmental crises in the ever-expanding metropolitan areas of Africa.

The oases of the Sahara provide a clear example of intensive (urban-like) agriculture, making efficient use of wastewater and solid waste as an agricultural input. Early colonial travelers reported aqua-terra farming systems in coastal Ghana. Nigerian cities have a pre-colonial history of livestock and horticultural production, a practice that continues and includes well-run markets.

In contrast to Asia, however, there has been only limited continuity of urban agricultural practices in Sub-Saharan Africa from the pre-colonial 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 colonials.

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 produce half or more of the chickens it consumes using technology introduced by colonials and adapted by local farmers (Case 4.5). In Kenya, urban farming occurs throughout cities despite little support from officials or NGOs.

In Lusaka, Zambia, a 1980 survey found that nearly 60 percent 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.[37] In the late 1970s, the worsening economic and food supply situation forced a policy change (Case 9.1).

In 1972, the Zairian government founded a cooperative to improve the supply of fruits and vegetables in the city, and by 1984, the co-op had about 5,000 members. A survey in three city zones of Kinshasa found almost 70 percent of women practicing agriculture in the early 1980s.[38] 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 practiced along roadsides, beside streams, 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 favoring urban agriculture.[39] Addis Ababa promoted community gardens, and Douala helped 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 toward 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 percent to 67 percent. 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 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 neighborhood and whose neighbors emulate him (Case 5.7), agricultural college professors using imported technology to earn money on the poultry market (Case 5.6), and an enterprising farmer growing spinach in raised beds along a roadside (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. Fortunately, Tanzania has become the site of multiple interventions (Case 6.4) that are helping the activity to be recognized and capture its potential. Tanzania has clearly become one of the world leaders in urban farming.

Contacts: Dr. Camillus J. Sawio, Petra Jacobi, Malongo Mlozi, and Zebedato Mvena (see Appendix F for complete addresses).

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 usually end up with low yields on land and labor. 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.

Europe

The discussion of urban agriculture in Europe may appropriately begin with Charlemagne. As emperor of the Holy Roman Empire, he issued an edict that spelled out which crops were to be grown within towns and cities in the 8th century. In medieval times and as recently as the 18th century, as much as half the area within the city wall was likely to be cultivated.[40] The area around the walls was also devoted to intense food production. Cattle that were grazed on nearby fields were likely to sleep inside the wall, where special stables or compounds were set aside for animals in times of emergency. The majority of urban waste was used as an agricultural input. The biggest negative contribution to the degradation of the biosphere may have been cutting wood for fuel, but some cities learned to manage sustained forests.

The industrial city brought with it home gardens for the well-to-do and allotments for workers. Although these rapidly growing cities, as described by Dickens and many others, had miles of biologically dead slums, other parts of the cityscape were green and put to a range of productive uses.

Market gardening, also called *truck farming* (from the French *troc,* to barter or swap), was as much a characteristic of the industrial city as was the assembly line. Truck farmers competed for space along the river and the railroad for easy access to irrigation and markets. Sites close to slaughterhouses and the stables of the horse drawn trolley companies were prime real estate for horticulture.

In the latter part of the 19th century, in response to living and nutritional conditions of the working poor, Abbé Lemire in France and Dr. Schreber in Germany pioneered movements for citizen mini-farms and gardens.[41] These still thrive in most European countries today.[42]

During the two world wars, as much as one-half of the nutrition (other than grains) of cities on both sides of the conflict was produced within and at the edge of the city.[43] However, the two wars represented an exception of sorts within a trend that lasted for decades. Indeed, a decline in urban agriculture that had begun in the late 19th century accelerated after World War II. In the post-war half century, urban agriculture in a divided Europe followed diverse paths, but in the 1970s and 1980s, a resurgence in both its eastern and western halves began. Some of the signs of the decline and comeback in European urban agriculture are discussed here.

Under socialism, dual food systems were established. The centralized agricultural system produced bushels and barrels of food but was unreliable in delivering it to consumers. The latter often produced their own food on a more dependable basis closer to (the mostly urban) home. Family survival/livelihood strategies, of necessity, began with food production within the human settlement — backyards, factory yards, hospital grounds, park lands, and land along roads were farmed on a small scale.[44]

With the decline of socialism and the return of a free-market economy, urban agriculture has blossomed in central and eastern Europe. Part of the expansion is due to the economic hardships that have accompanied the transition period of the past decade. The expansion even predates the fall of communism because greater self-reliance had already become necessary prior to the 1990s. The Gorbachev liberalization included

official support for household and community urban agriculture. The response across Russia was fast and strong. This policy shift followed the lead of China and was itself followed by Romania and others.[45]

As a result, 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 percent in 1970 to 65 percent in 1990) is remarkable. Similar, if perhaps less dramatic, shifts are occurring in many Eastern European cities, from Wroclaw **(**see Case 3.6**)** to Sofia (Case 2.6) all the way to Vladivostock, as policies and economies change.

Case 2.6 Urban Agriculture in Bulgaria

At the beginning of 1997, the economic situation in Bulgaria appeared to be severe — an inflation rate over 300 percent per month, minimum legal salaries of $14 per month, and pensions too low to provide the basic caloric intake. Closer examination, however, showed a completely different picture — little malnutrition, low food prices, and even an active construction industry along with the hardship situation generated by unemployment and the disaster of the conventional economy. This apparent paradox was easy to explain once urban agriculture was considered.

In the outskirts of cities and in all villages, 900,000 households (2.5 million people) had gardens that were very carefully cultivated with vegetables, grains, and fruits. Even the space over sidewalks was covered with a canopy of grapes, cucumbers, and squash. All rural (village) dwellers and most city dwellers were also making home preserves. An analysis of randomly selected households showed a shadow production value (even at very low local market value) of about $1,400 per family. Household producers were sustaining the national economy with informal activity that was worth at least 13 percent of the GNP. Urban agriculture is practiced by at least 30 percent of the country's population in its primary production and by almost the whole society in its secondary stages.

The Bulgarian minifarm is a very careful multidimensional optimization of resources. For every calorie of external inputs, several calories of food are produced. Many of the resource and nutrient cycles are closed through extensive recycling.

The culture of urban agriculture was able to survive four decades of collective agricultural production. The Bulgarian government, multilateral aid, and financial organizations have been trying to find the key to moving the country toward the market economy by using different types of support and incentives to create private enterprises. One of the keys to the development of an active private sector may lie in further fostering the strong presence of urban agriculture.

Contact: Jorge Zapp (see Appendix F for complete address).

It is noteworthy that the pattern of urban construction under the former communist regimes creates a unique opportunity to promote 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 centers than in Western Europe. Thus there

is considerable potential to expand 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 increasingly offers more advantages.

At the same time in Western Europe, a similar decline and revival can be noted, but under highly different circumstances. With the 'modernization' of agriculture in the decades after World War II, farming in and around cities lost its specificity, and its main function became as a land reserve for the massive new housing areas, from which it remained disconnected. During more recent decades, urban agriculture has increased its importance in Western Europe, for a variety of reasons.

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. A special case existed here because the locally elected governments between the 1950s and 1980s were predominantly socialist while the national governments tended to be not very stable Christian Democratic. The local governments gave strong support to local farmer cooperatives and vice versa. The result was and still is, a thriving urban/peri-urban agriculture and marketing food system compared to some other European countries.[46] Italy now leads Europe with the so-called 'slow food' movement as a positive reaction against fast food. This movement promotes a 'grow it, cook it, eat it slowly' approach — for the good of the family, community, and globe.

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).

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 urban nations. This apparent contradiction of being highly urban and densely populated *and* 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.

Within the core area, the increasing pressure of urbanization is affecting the Randstad, with some gnawing at the integrity of the agricultural core by construction, as well as reluctance by farmers to reinvest in the capital-intensive industry in this area. The intense production in these districts is also causing serious environmental problems, notably from manure. As a result, the government and the Dutch growers' organization have jointly drawn up a plan to restructure the country's greenhouse industry. They allocated hundreds of hectares outside the core for new sheltered agriculture and will spend over $100 million to develop the infrastructure that is necessary to operate these new areas and help growers plan their move there. The Netherlands remains at the forefront of jointly planning agriculture and urbanization.

Contact: ETC Foundation (see Appendix F for complete address).

Throughout Europe there is new interest in community gardens and '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.[47] 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, policies that are encouraging urban and peri-urban agriculture. In the UK, farmers' markets are following the American model,[48] and organic produce sales in 2000 were up 40 percent over 1999. France adopted a national community gardening program in the 1980s, and in the 1990s adopted legislation that hinders construction or operation of additional supermarkets nationwide in favor of small locally-based food retailers.

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.

North America

Early European immigrants to North America brought the urban agriculture system of the 'town commons'. Intensive crop and livestock production was practiced as it was in European villages and towns. This system was enhanced in hundreds of ideal or planned communities from Maine to Iowa (such as New Harmony, Indiana and Salem, North Carolina) as white settlements pushed westwards.

The arrival of massive industrialization accompanied by urbanization rapidly changed this context, and market gardening to serve the mushrooming towns quickly emerged. The economic crisis of 1882 introduced community farming on vacant lots to major cities. As boom-and-bust cycles recurred, many cities would find themselves with scattered unused properties, and they started leasing lots for a penny a year to unemployed citizens and charitable groups.

By 1900, urban agriculture in the United States and Canada was an expression of European immigration. Much specialization developed by group and location. In New York, for instance, Greeks farmed on Staten Island, Italians in Brooklyn.[49] In many instances, producers in the city were selling their products to nearby suburban and rural towns and villages as well as to the city market.[50] Greenhouses (using steam heat) and cold frames (heated by the sun and compost) were as much in evidence as the factory and

storage warehouse in the urban landscape. Some cities, including Philadelphia, had laws giving urban farmers a special tax advantage over other businesses.

World War I gave a boost to urban agriculture in North America just as it did in Europe. Municipalities supported the home grower and commercial grower alike to raise perishable foods. The national effort extended to for-profit corporations. For instance, Standard Oil of California transformed the street fronts of their gas stations from flower gardens to vegetable gardens.[51] The victory gardens of World War II made as great a contribution to urban food security as their predecessors did during World War I. Some continue today as community gardens, including the Back Bay Fens in Boston and Rock Creek Park in Washington, D.C.

Both urban household food production and peri-urban market gardening were thus significant subsectors of the food and agriculture system in North America until the 1950s, when they declined sharply in all but small towns. That decline, however, had really started decades earlier. From the beginning of the century and particularly between the world wars, in Canada and the United States the rise of land-use planning disallowed agriculture in residential and some other zones. Production for northern cities began in the southern and western states, relying on the ubiquitous use of cold storage and refrigerated rail and highway shipping. From the 1950s onward, vertically integrated agribusinesses began to stretch from the (Mexican) field to the (Canadian) supermarket. And urban farming went into recession.

For the last quarter of the 20th century and particularly during the final decade, urban agriculture has been making a comeback in North America. Today, we see fish farming on the sites of tenement houses from the 1910s in New York City's Bronx.[52] The U.S. Department of Agriculture reports the nation's highest economic yields per acre are in San Francisco.[53] An abandoned factory site in Buffalo, New York is now 18 acres of tomatoes (see Case 4.4). American suburbs such as Loudoun County, Virginia are undergoing a revolution in their agriculture while simultaneously booming in population.

A resurgence of community and home gardens starting in the 1970s was partly a result of growing concern about food quality, a concern that increased consumer demand for locally-grown products. The 1994 national gardening survey revealed that 30 percent of United States families were gardeners, with fully 80 percent of them urban dwellers.[54] Similar levels have been estimated for Canada (Case 2.8). The American Community Gardeners Association was formed to increase the sense of community among gardeners. As in Europe, the community-supported agriculture (CSA) movement is beginning to expand in North America.[55] CSA retailing is expanding rapidly, as are its sisters — farm-to-school, farm-to-campus, restaurant-supported agriculture, and institutional-based agriculture (including prisons).

Case 2.8 Urban agriculture in Canada

In the 1990s, Canada took the lead in international support for urban agriculture, particularly in developing countries. This is highlighted in two ways — Vancouver is home to the Internet's single most important site on the subject (www.cityfarmer.org), and the government's

International Development Research Centre (IDRC) currently has the most important funding program globally, Cities Feeding People. This has been paralleled by Canada's emergence as one of the leading developed nations to recognize the role of urban agriculture and provide multifaceted support for further development. This case illustrates some examples of the latter.

Municipal initiatives related to urban agriculture in Canada tend to be more immediately concerned with issues of environmental conservation, economic efficiency, and recreation, rather than food production. However, Canadian municipalities have initiated a limited number of programs, such as demonstration gardens, organic gardening courses, and community gardening programs that directly address urban gardening. For example, in Goulbourn, Ontario, the Environmental Youth Corps Program, sponsored by the township's Environmental Advisory Committee, built a successful organic demonstration garden.

The Island of Montreal, with a population of 2 million in 15 municipalities, has one of the best community gardening programs in North America. The city maintains 75 garden sites containing 6,654 allotment plots. The program is run by the Department of Recreation, Parks and Community Development, which provides soil, manure, fencing, water, tools, toilets, clubhouses, tool sheds, and ongoing maintenance. In addition, there are five paid horticultural advisors who are responsible for a group of sites. These resource people answer any horticulture inquiries, work with the executive of each garden group, and report to the Public Works Department on any maintenance problems. Pierre Bourque, community garden champion, was elected mayor in the mid-1990s.

Toronto is pioneering a new frontier in agriculture — rooftop farming. It is home to the Rooftop Garden Resource Group. For instance, three students from the University of Toronto use the rooftop of a warehouse in the city owned by Field to Table, a food service, to grow high-value, organically certified vegetables for sale to local restaurants and other high-end consumers. They are attempting to modify the building into a model urban farm. Despite a strong planning system, the Greater Toronto area's urban sprawl consumes roughly 5,000 hectares per year, much of it farmland. In the long term, that might make urban agriculture a necessity, and rooftops a lucrative space. Toronto is also home to one of the most active food councils in North America, the Toronto Food Policy Council.

The growing prominence of recycling organic waste by composting is having the most significant effect on the role and extent of urban agricultural activities in Canadian municipalities. Driving solid waste management initiatives in these municipalities is a desire to reduce the amount of waste traditionally destined for municipal landfills. Prominent examples of solid waste management can be found in the Greater Vancouver Regional District, British Columbia and Port Colborne, Ontario. Core components of their municipal organic waste recycling rest with encouraging the participation of individual homeowners and the institutional, commercial, and industrial sectors, and the establishment of centralized, municipally-operated composting facilities. Municipally-sponsored Compost Education and Demonstration Centres offer training in outdoor and indoor composting workshops, and guest lectures to adults as well as school children. Residential composting is also promoted through policies restricting the collection of certain kinds of waste normally collected through the municipal waste management system.

The growing recognition that the by-product of the wastewater treatment process can be used as a high quality, cost-effective fertilizer, is leading an increasing number of Canadian municipalities to implement wastewater reuse and reduction projects. Municipalities such as Gander, Newfoundland generate thousands of tons of sludge annually. Gander is attempting to divert 100 percent of the sludge from one of the town's two wastewater treatment centers so it is no longer sent to a landfill.

Contact: Michael Levenston and Brenda Lee Wilson (see Appendix F for complete address).

Since the early 1970s, New York City has supported more than 1,000 community gardens on public land. The government has opened 18 farmer's markets for direct sale of locally grown farm products. Other United States cities such as Boston and Philadelphia have even more community gardens per capita than New York. In Seattle, New York, and Washington, D.C., projects help the homeless produce their own food and community and home farmers contribute fresh food to their homeless neighbors.

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.[56]

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 United States census found that urban metropolitan areas produced 30 percent of the dollar value of American agricultural production. [57] By 1996, it had increased to 40 percent. At the same time, as urban areas expand, thousands of acres of peri-urban land are lost to agricultural production. Although this loss is recognized more and more as an issue of national as well as local significance, the importance of metropolitan-intensive production is not yet fully realized in North America. Higher-value crops such as poultry and vegetables make a particularly significant nutritional and economic contribution.

Latin America and the Caribbean

The arrival of Hernán Cortez in Tenochtitlan, now Mexico City, may be a good place to start considering the presence of urban agriculture in Latin America. He was stunned to find a city larger than any in Europe, substantially nourished by the *Chinampas* aqua-terra urban agriculture system **(**Case 4.9). Indeed, the tradition of urban agriculture seems to be at least as old, albeit less continuous, in Latin America as in Asia. The Aztecs, Incas, Mayans, and earlier pre-Columbian civilizations had highly developed and intensive agriculture systems. Most of these ancient systems were destroyed and abandoned with the European takeover.[58] Today, researchers are examining the remaining evidence to learn from the highly productive and sustainable agricultural practices.[59]

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 World War II, urban agriculture re-emerged in the shantytowns surrounding old colonial cities. In some cases (for example, the *chinampas*), the growing city engulfed a specialized farming system.

Most new urban agriculture was based on rural European models and was not very productive. However, Asian technology using intensive production was introduced in some places, including in São Paulo by the Japanese and in Panama by the Taiwanese. Some French biointensive technology has been introduced by American and international humanitarian organizations. Some native animals, such as guinea pigs, quail, 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 program from some governments, churches, and charities. Activities ranged from school gardens supported by UNICEF in Panama[60] to a community garden in a prostitution district in northeastern Brazil. With the help of United States technology, some urban agriculture was developed for export, most notably flowers from the Bogotá savanna and vegetables and grapes from the Valparaiso-Santiago plain.

Asian and European technologies, especially in fish farming, were introduced in the 1980s 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 hydroponics (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 2.9). 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 programs, as does Mexico City.

Part of this new official support is a direct result of recognizing the great impact of various economic crises (and sometimes civil wars that accompanied them) in the 1980s, 1990s, and in this new century. These crises fostered a significant increase in farming activity as an economic strategy for urban households. Cuba may have been the most noteworthy for the agricultural revolution it undertook in the early 1990s (see Case 7.6), but countless other examples also exist, from Mexico to Chile.

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 Research Network (AGUILA) to promote the industry.[61] The tradition of urban farming in Latin America may thus be coming full circle from the days of the Incas and Aztecs.

Case 2.9 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 programs of food production for the family. 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 7.2).

The national government, through the Ministry for Women and several national organizations — Pronaa (Programa Nacional de Apoyo a la Alimentacion), Foncodes (Fondo de Compensacion y Desarrollo Social), Coopoc (Cooperacion Popular) — are providing support to urban agriculture. Each has good experience with urban agriculture in the community.

Sewage-fed fish technology developed at the CEPIS research center is being considered for adoption in Bolivia, Mexico, Colombia (Cali), and Cuba (Case 5.5). In Peru, it is being advanced by a government agency, PRODANET, to green the desert. CEPIS has received World Bank support, and PRODANET is supported by the Food and Agriculture Organization. Other NGOs are doing advanced applied research in composting, guinea pig rearing, and microenterprise and are promoting these methods in surrounding countries.

IMAGEN is supporting small-scale hydroponics in low-income areas. Currently, it is selling regularly to a 23-store supermarket chain (Tiendas Wong). REDE, under the direction of Andres Dasso, has done a study of 27 organizations in Peru that are active and successful in urban agriculture. In addition to hydroponics and aquaculture, the production of guinea pigs and quail has been particularly successful in Peru.

The small poor country of Peru is successfully applying new techniques and organizational approaches to promoting urban agriculture. It is starting to benefit substantially from international assistance for this endeavor.

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Comparisons Across Continents

Over the past few decades, there have been dramatic shifts toward urban agriculture in both developed and developing countries. Production volume has increased, and improved technologies and methods have been adopted.

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

Sub-Saharan Africa has shown the most dramatic expansion 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. The expansion in the number of countries with civil strife, such as Zaire, Uganda, and Mozambique, gives it the greatest potential for the use of farming in emergency settings. Undoubtedly, Africa has been the most extensively surveyed during the past two decades.

Latin America has some of the most improved uses of urban agriculture methods such as small-scale hydroponics and small livestock rearing. Latin American 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. Latin American researchers have also managed to organize themselves on a continent-wide basis faster than in any other region.

Urban agriculture is most extensively practiced in Asia, but growth and change in the industry there is less apparent. Both municipal and national governments in Asia are more supportive of urban farming on a day-to-day basis than governments in the rest of the world. The need for assistance to the urban poor is no less pressing in Asia than in other parts of the developing world, and theoretically this assistance should be easier to obtain because the know-how is more ubiquitous. Viet Nam, Taiwan (province of China), Australia, and Singapore are trendsetters.

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:

- food costs for lower-income groups may be one-fifth to one-third of urban family budgets (compared to one-third to four-fifths in poor countries),
- food distribution systems are generally more complete; and
- food is both of higher quality and more accessible.

Urban areas in more developed countries are generally less densely populated and have more land available for raising crops and animals. With increased consumption, the per capita volumes of wastewater and solid waste (with their potential for reuse in farming) are higher. The potential environmental hazards of those wastes are usually also 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.

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 different circumstances also mean that regional variations in benefits, problems, and constraints will need to be understood before appropriate strategies are devised for each locale.

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

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