CHAPTER 3

Farming the Cities

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On the surface, Accra in Ghana, Beijing in China, and Vancouver in Canada seem to have little in common. They range in population from roughly 2 million in the metropolitan region of Vancouver to more than 14.5 million in Beijing. The per capita incomes are vastly different: about $700 a year in most of Ghana, about $2,200 in Beijing, and more than $32,000 in Vancouver. But take a closer look, digging a little deeper into the backyard and rooftop gardens, and you'll realize that these city folk share a preoccupation that has thrived since the first cities—raising food.[1]

Accra has a population of 6 million, including a steady supply of migrants from rural areas and immigrants who seek work in its factories. Because food is expensive, people farm anywhere they can: in backyard plots, in empty lots, along roadsides, and in abandoned dumps. These farmers grow a variety of crops for home use and sale, including exotic varieties like green peppers, spring onions, and cauliflower, as well as more traditional crops like okra, hot peppers, and leafy greens such as alefi and suwule.[2]

There are more than 1,000 such farmers in Accra. Their plots vary from just one tenth or one twentieth of a hectare (10 meters by 10 meters) to 20 hectares in the city outskirts. Among the biggest challenges they face is keeping their crops irrigated, since clean, affordable sources of water are not easy to find. Backyard farmers often use greywater—the waste water from bathrooms and kitchens. While sewage water can be a health hazard, farmers in Accra—and in cities all over the world—are finding that human waste can be a valuable fertilizer.[3]

In Beijing, city planners in the 1990s decided that urban agriculture was an important way to meet the city's food needs, preserve green spaces, and conserve the region's water and land resources more efficiently. They began offering courses and assistance for aspiring farmers, they surveyed existing land use to better understand the extent of urban farming, and they tried to incorporate urban farming into long-term city planning decisions.[4]

Today, urban and peri-urban agriculture

(farming in, around, and near cities) in Beijing not only provides residents with safer, healthier food, it also keeps farmers in business. Between 1995 and 2003, the income for farmers living just outside of Beijing doubled. The city includes tens of thousands of household farms and more than 1,900 agrotourism gardens for Beijing residents craving some rural experience. Although the share of the city's population involved in farming is currently very small—just about 1 percent—the municipal government plans to cultivate gardens on 3 million square meters of roof space over the next 10 years.[5]

Vancouver is known for being a popular destination for tourists. But what most visitors do not realize is that the city is a leader in encouraging its inhabitants to grow and buy fruits, vegetables, and other items produced in the city. According to a recent survey, an impressive 44 percent of Vancouverites grow vegetables, fruit, berries, nuts, or herbs in their yards, on their balconies, or in one of the 17 community gardens located on city property. Vancouver's mild temperatures and ice-free winters make it the ideal city to grow food nearly year-round. There, farming the city is part of a much larger movement that includes restaurants buying from local farms, buying clubs in which neighbors subscribe to weekly deliveries of produce, and the heavily attended Feast of Fields harvest festival twice a year on a farm outside the city that exposes city folk to rural life.[6]

A Rich History of Urban Farming

Growing food and raising fish and livestock in Accra, Beijing, and Vancouver—indeed, in cities all over the world—is nothing new. In some ways, these three cities are responding to the same challenges that urban gardeners have faced for millennia. The hanging gardens in Babylon, for instance, were an example of urban agriculture, while residents of the first cities of ancient Iran, Syria, and Iraq produced vegetables in home gardens. This is partly because cities have traditionally sprung up on the best farmland—the same flat land that is good for farming is also easiest for constructing office buildings, condominiums, and factories—and partly because the masses of urban dwellers create a perfect market for fresh fruits and vegetables.

"In ancient times, the cost of transport was much greater," explains Jac Smit, head of the Urban Agriculture Network, "so the impetus for growing food in cities was greater." Of course, urban farmers continued to refine their craft. Centuries after the Incan residents of Machu Picchu raised food in small, intensive plots irrigated with the city's wastewater, enterprising Parisians developed bio-intensive production with steam-heated greenhouses and glass cloches that cover individual heads of lettuce; they sold their produce as far away as London. In China's cities, farmers developed complex cropping patterns and trellises that made use of every available square meter.[7]

But like the story of all local farming, a range of forces in the modern era—the Industrial Revolution, the evolution of the megacity, the invention of refrigeration—helped to render urban farming obsolete. In particular, when cities first combined industrial and organic wastes in one sewage stream at the end of the nineteenth century, they made wastewater too toxic for irrigation. And in many cities, urban agriculture became not only harder to practice but illegal as well, thanks to overzealous city officials and public health practitioners who wanted to eliminate urban livestock production.

Then during the 1970s, something changed. People working for the United Nations, the Peace Corps, and other development groups noticed the spontaneous

appearance of home gardens and small retail farms in major cities throughout Asia, Latin America, and Africa. Rapid urbanization, inefficient and expensive transportation, and a greater demand for food made raising produce and livestock in cities possible and necessary. In other words, the same needs that had given rise to urban farming in ancient times had reappeared. And although cities in industrial countries might be able to compensate for traffic congestion and lack of local food with superior transportation and packaging, those in developing countries could not. Urban farming was posed to take off again.[8]

In fact, farming is ubiquitous in cities today. The U.N. Development Programme estimates that 800 million people are involved in urban farming worldwide, with the majority in Asian cities. Of these, 200 million produce food primarily for the market, but the great majority raise food for their own families. In a survey conducted for the United Nations, cities worldwide already produce about one third of the food consumed by their residents on average, a percentage that will likely grow in coming decades, given that the need for urban agriculture could be greater now than ever before.[9]

According to the U.N. Food and Agriculture Organization (FAO), the number of hungry people living in cities is growing. While malnutrition in rural areas is still a bigger problem in terms of actual numbers of people—of the 852 million people worldwide who are undernourished, 75 percent live in rural areas—urban residents, particularly children, also suffer from food shortages as well as micronutrient deficiencies. Urban agriculture can be one of the most important factors in improving childhood nutrition, by increasing both access to food and nutritional quality. Recent studies in the Philippines and elsewhere confirm this linkage between better childhood nutrition and the production of food in urban areas.[10]

Fortunately, urban politicians, businesses, and planners are beginning to regard urban agriculture as a tool to help cities cope with a range of ecological, social, and nutritional challenges—from sprawl to malnutrition to swelling landfills and the threat of attacks on the food chain. In this context, taking advantage of land in and around cities is essential and obvious. Unlike parks or other green space, which are generally financed by taxpayers, urban farming can be a functioning business that pays for itself. And for cities that use nearby farmland to filter wastewater, recycle garbage, and cool down the concrete jungle, farming is rapidly becoming something they can't do without.[11]

Replenishing Food Deserts

Local food takes on a very different meaning on a planet where half the people live in cities. As a greater share of the world's population resides farther from where food is grown, produce has to be moved across countries and sometimes around the world.

In 2001, FAO officials were concerned about the capacity of large cities in Asia, Latin America, and Africa to feed themselves. They found that by 2010 many of these cities will require massive increases in the number of truckloads of food coming into the area each year—increases that would overwhelm the capacity of these cities to distribute food. Bangkok will need 104,000 additional 10-ton truckloads each year, Jakarta will need 205,000, Karachi 217,000, Beijing nearly 303,000, and Shanghai just under 360,000. And while cities may never be able to meet all their food needs from local farmland, the tremendous infrastructure, energy, and cost required to shuttle food into densely populated areas argues for urban centers to secure as much of their food as possible from farm-

land within their borders or nearby.[12]

For the inhabitants, cities bring certain gastronomic advantages. A diversity of people and businesses means access to a wide range of cuisines compared with more-traditional fare in the countryside. Cosmopolitan commerce means that specialized stores and international supermarkets stock a variety of ingredients. At the same time, a more harried urban lifestyle often means that city folk have less time to cook or prepare meals from raw ingredients and that they opt for the convenience of processed, prepared, or even fast food. (Consumers in urban areas pay up to 30 percent more for their food than people in rural areas do, partly because they grow fewer of their own ingredients and partly because the food travels farther.)[13]

But the change in habits raises all sorts of nutritional and logistical concerns. Foods that are more processed require more refrigeration, clean water for preparation, and sophisticated transport lines. They also mean more sugar and fat in the diet, which combined with more sedentary urban lifestyles encourages diabetes and obesity. A study of 133 developing countries found that migration to the city—without any changes in income—can more than double per capita intake of sweeteners, simply because they are available cheaply. Traditional staples—whole grains, potatoes and other root crops, and some vegetables—on the other hand, are often more expensive in urban areas. For example, surveys show that recent migrants to Hanoi, Viet Nam, eat less rice, corn, vegetables, and beans than they used to and more meat, fish, eggs, milk, soft drinks, and canned and processed food. Home-prepared meals are gradually replaced by restaurant fare and street food.[14]

So this is the essence of the urban food quandary: People living in cities demand more food and a greater range of foods than their rural counterparts, but they live farther from the centers of food production. In response, people often start farming in the city simply because they cannot find an affordable and reliable source of the foods they crave from their rural roots or because they might not have the cash to buy food at all. As opposed to in the countryside, in cities a lack of money translates more directly into lack of food.[15]

In other words, growing food is not a hobby for most people, it is a necessity. Studies from several African cities have shown that families engaged in urban agriculture eat better, as measured by caloric and protein intake or children's growth rates. In terms of providing an essential source of food and income, urban and peri-urban agriculture is probably most important in sub-Saharan Africa. In the cities and towns in East Africa, a third of urban dwellers are engaged in agriculture. In West Africa, the number of households involved in urban agriculture varies from more than 50 percent in Dakar, Senegal, to roughly 14 percent in Accra, Ghana. In Dar es Salaam, Tanzania, 60 percent of the milk sold is produced right in the city.[16]

In densely populated Bangkok, home to roughly 10 million people, rising demand for aquaculture products such as morning glory, water mimosa, and freshwater fish is met primarily by an industry of peri-urban water farmers. Nearly one third of the nation's intensive urban aquaculture production comes from around Bangkok, and it generates about $75 million each year. Catfish farms in the northern part of the city produce more than 70 percent of the country's total output of this fish. And about 40 kilometers west of Bangkok, there are vast farms growing the aquatic plant morning glory (a staple of the Thai diet), while 20 kilometers south of the city tilapia and carp thrive in large ponds.[17]

Farms in the city can often supply markets on a more regular basis than distant rural

farms can, particularly when refrigeration is scarce or during a rainy season when roads are bad. And local food production might be the best option for feeding urbanites neglected by the long-distance food chain. In both the industrial and the developing world, poorer urban households typically spend a greater share of their income on food than wealthier urbanites do. In some cases, poor urbanites spend 60–80 percent of their income on food, making them especially vulnerable to price changes.[18]

Nutritionists and sociologists have argued that many poor inner-city areas in industrial countries have become "food deserts" in recent decades. Supermarkets have left the inner cities to milk the more lucrative suburban markets, after pushing many of the independent mom-and-pop grocers out of business. Entire city neighborhoods have been left with only fast-food restaurants and convenience stores. This provides a good opportunity for farmers' markets and community-supported agriculture subscriptions, in addition to food co-ops and other locally owned stores. In the Anacostia region of Washington, DC, which has not had a supermarket for years, a new farmers' market is the first good source of fresh food for local residents.[19]

This reliance on city farmers is not always planned. Cuba depends heavily on urban farming—an estimated 90 percent of the produce eaten in Havana is grown in and around the city. The shift, however, was not entirely voluntary. In the early 1990s, the U.S. embargo and then the collapse of the Soviet Union left Cuba without agrochemicals, farm machinery, food imports, or petroleum, hobbling its capacity to produce food and ship it to cities. Confronted with massive food shortages, government officials set up a loose network of local extension offices that helped Cubans obtain vacant land, seeds, water, and gardening assistance.[20]

Cuba's main motivation was preventing a shortfall of food, but its support for city farming has also been a wise investment in jobs and crisis prevention. Urban farming in Cuba has created 160,000 jobs, including farmworkers, masons, vendors, herb dryers, and compost makers. Egidio Paez of the Cuban Association of Agricultural and Forestry Technicians notes that "the growth and spread of cities invariably creates many empty spaces...which often become trash-dumps that are sources of mosquitoes, rats and other disease vectors." Transforming these unhealthy spaces into farms and garden spaces creates jobs. Cuba's urban farmers raise food organically—without pesticides or chemical fertilizers—eliminating the health and environmental problems that result from agrochemicals.[21]

These welcome benefits of urban farming are needed in many countries. In Yaoundé, Cameroon, more than 70 percent of urban farmers do not have other occupations, a figure that rises to 85 percent in Abidjan, Côte d'Ivoire. In peri-urban Hanoi, agriculture still generates more than half of the incomes in some sections. In Kumasi, Ghana, the annual incomes of some urban farmers were estimated at $400–800, which is two to three times what they could make in rural farming.[22]

In many cases, farming is particularly suited to city folk without jobs or some outlet for developing skills for the working world. In Boston, Massachusetts, the Food Project trains inner-city youth how to do many of the jobs associated with a commercial catering business; the youngsters work on a farm, harvest the food, prepare it, and serve it at events. In Cairo, Egypt, teenage girls who are not allowed out of the house according to religious customs have found a calling—and generated their own income—by tending rooftop vegetable gardens. They use wastewater from their apartment buildings and have developed networks of friends and fam-

ilies for marketing the produce.[23]

Beyond providing jobs and good nutrition, urban farming can have a whole range of other health benefits. Research has connected gardening to reducing risks of obesity, heart disease, diabetes, and occupational injuries. For urban folks especially, working with plants and being in the outdoors can both prevent illness and help with healing. Some health professionals use plants and gardening materials to help patients cope with mental illness and improve their social skills, self-esteem, and use of leisure time. Horticulture therapy is relaxing and reduces stress, fear and anger, blood pressure, and muscle tension; it can also lessen patients' dependence on medications.[24]

Wayne Roberts of the Toronto Food Policy Council sees urban agriculture as the "new frontier in public health," benefiting health twice: first, by supplying urbanites with more foods and, second, by affording them the exercise involved in raising food. Roberts notes that obesity is epidemic in most wealthy nations and increasingly in Third World cities. Having food produced locally can radically change people's attitudes toward the produce. "Instead of pop and candy vending machines plastering the cityscape, people see fresh fruits and vegetables," notes Roberts.[25]

Because gardens can provide a social beacon in urban areas, their potential to educate extends beyond the basics of planting. In Lilongwe, Malawi, the Peace Corps has been using urban gardens as a way to raise medicinal plants and educate people about AIDS. According to Anne Bellows, a research associate at the Food Policy Institute in New Jersey, beyond physical health "urban gardens bring people together in public space, resulting in community growth, education, healthy lifestyles, and fun."[26]

Roberts also envisions a third way in which urban agriculture can benefit public health—by improving the social determinants of health, including the beauty and safety of neighborhoods and the strength of community ties and social interactions. Studies show that people at farmers' markets have as many as 10 times more conversations, greetings, and other social interactions than people in supermarkets. City planners are learning that farmers' markets can be used to bring people together in a central location, becoming a forum for politicians, activists, and other community leaders to raise awareness about local issues.[27]

A survey of community gardens in New York found that having a garden improved residents' attitudes toward their neighborhood, reduced littering, improved the maintenance of neighboring properties, and increased neighborhood pride. They also found that the presence of gardens was four times more likely to spur other community efforts in low-income neighborhoods than in high-income ones, due to a greater number of pressing community issues and a lack of meeting places. Add to this the other well-documented effects of community gardens—including greater consumption of fresh vegetables, reduced grocery costs, and the various psychological and health benefits associated with exercise in a natural setting—and it becomes clear that urban farming does a lot more than just replenish food supplies.[28]

Healing the Concrete Jungle

As cities strive to be more self-sufficient in food, several obstacles stand in their way. On the most practical level, tall buildings often obscure sunlight (although rooftop gardens provide one solution), and urban soils may be contaminated with the residue of past industries (although pesticide-laden rural soils are often not much cleaner). Raising livestock or fish close to dense human dwellings and the

strain urban farming can place on an already tight city water supply present unique health and environmental challenges for cities. Handled appropriately, however, urban farming can actually serve to diffuse the potential public health issues and might even improve water quality.[29]

As fresh water becomes a more and more precious commodity in cities, using every drop more than once becomes important. Although urban farmers use rainwater and water from nearby rivers and streams to grow crops, many also use a source of water that is widely available in all cities—human waste. The International Water Management Institute (IWMI) estimates that wastewater is used on more than 50 percent of the urban vegetable supply in several Asian and African cities. (See Box 3–1.) In addition to contaminated water, urban farmers and consumers also have to worry about other sources of pollution in their food, including heavy metals and other toxins that can contaminate the soil.[30]

Despite these problems, urban farming can bring a bit of the country into the concrete jungle, creating benefits that reach well beyond a city farmer who makes more money or a city resident who has a more stable food supply. (See Table 3–1.) Urban farms bring some needed diversity to the urban landscape. They provide ground to help catch and filter rainwater; land for composting and reusing of organic wastes; city trees to create shade, reduce heat, and cut down on greenhouse gases; and even buffer zones for flood- or earthquake-prone areas. Shady, flower-filled plots might provide a respite for the weary urban soul, but these spaces can also heal the toxic city environment.[31]

In the broader sense, urban farming can also be an extremely efficient use of natural resources. Intensive production of vegeta-

Box 3–1. Urban Agriculture and Wastewater Use

It is hard to believe, but much of the food grown in cities in the developing world is irrigated with polluted water. Why? The reason is simple—wastewater from sewage systems and even raw urine and feces are low-cost, nutrient-rich sources of irrigation for the poor in urban areas. Worldwide, 3.5–4.5 million hectares of land are irrigated with wastewater. But wastewater contains a whole range of pathogens that can survive for weeks after being applied to fields, posing a public health threat.

Most wastewater irrigation is done informally. City authorities know it is taking place, but they lack the money or infrastructure to offer an alternative. In Ghana, there are few data on the extent of informal irrigation in the country, but in Kumasi (with a population of 1 million) at least 12,700 farmers irrigate more than 11,900 hectares in the dry season—more than twice the area with formal irrigation in the entire country.

In Accra, Ghana, 200,000 people a day eat salad from irrigated urban agriculture. While this production contributes to a diversified diet, it also gives a sense of the number of people potentially at risk from polluted water.

Governments and nongovernmental organizations, such as the International Water Management Institute, are working to educate urban dwellers about the risks and benefits associated with wastewater irrigation. Without it, however, millions of people would go hungry. Guidelines for using wastewater need to be flexible, reducing risks to public health and not punishing urban farmers for irrigating their crops.

—Pay Drechsel, International Water Management Institute

SOURCE: See endnote 30.

Table 3–1. Multiple Uses and Benefits of Urban Agriculture

Use	City	Benefit
Sewage treatment and aquaculture	Beung Cheung Ek Lake, Cambodia	Thousands of families living around this sewage-contaminated lake cultivate water spinach—a local staple that thrives in nutrient-rich waters. For thousands of years Asians have been using aquaculture ponds enriched with human wastes to grow plants, rear fish, control floodwaters, and remove local pollutants.
Crisis prevention and food security	Cities in Cuba; Freetown, Sierra Leone	In response to the U.S. embargo, Cuban officials designed a network of urban gardens. In 1999 urban farmers produced on average 215 grams of fruits and vegetables per day per Cuban—in some cities harvests exceed the 300 grams per day target set by health ministers. A similar system exists in Freetown, where war forced residents, refugees, and schoolchildren to rely on urban agriculture.
Bioremediation and phytoremediation	New Orleans, United States	Hurricanes Katrina and Rita unleashed dangerous levels of DDT, arsenic, lead, and other soil toxins. But citywide plantings of sun flowers, wild mustard, oyster mushrooms, and compost are helping sequester and break down these toxins.
Creating equity and controlling crime	Los Angeles, United States; St. Petersburg, Russia	Teens in Los Angeles grow produce to sell at farmers' markets. St. Petersburg prisons use rooftop gardens to create income, pride, and a valuable sense of community.
Erosion and landslide prevention	San Salvador, El Salvador	One of the few remaining forested areas around the rapidly growing city is a 120-hectare parcel called El Espino. Known as the "lungs" of the city, it provides fresh air and groundwater replenishment for the city's water supply. Managed by a cooperative of coffee growers who tend their bushes in the forest's understory, El Espino has more than 50 species of trees and shrubs, which shelter 70 species of birds, including some not found elsewhere. In recent years, much of El Espino has been developed, however, and during Tropical Storm Stan in 2005, massive flooding caused huge landslides in areas that had withstood previous storms.

SOURCE: See endnote 31.

bles in cities can use less than a fifth as much irrigation water and one sixth as much land as mechanized rural cultivation. In Freiberg, Germany, officials subsidize farmers on the steep hillsides surrounding the city in order to reduce the risk of erosion. Coffee farms in the hills around San Salvador, El Salvador, serve the same purpose, and a proposed tax on the city water (which depends on the presence of forest-laden coffee farms in the watershed) would help keep these farmers in business.[32]

In the East Kolkata wetlands of India, farmers are helping protect the environment as well as earning a living. The wetlands cover 12,500 hectares and include 254 wild and farmed fisheries, space for agricultural production, and residences. And they happen to be on the coastal edge of one of India's most densely populated cities,

Kolkata (formerly Calcutta), where the wetlands are the primary means of absorbing wastewater from the city's sewers. In a unique system of recycling, the fish and vegetable farms extract nutrients from the city's wastewater; fish ponds covering about 4,000 hectares encourage a range of physical, biological, and chemical processes that help improve the quality of water before it empties into the Indian Ocean.[33]

Popularly known as the kidney of the city, the Kolkata wetlands produce roughly 18,000 tons of fish each year for sale and support around 60,000 residents through fishing, fish farming, fish processing, and related activities. Ironically, while such benefits have been an inspiration to coastal cities around the world, this has not kept speculators from increasing pressure on the government to develop these areas for residential and industrial purposes.[34]

Urban farmers are also adept at turning what some consider problems into solutions. "Despite the health and environmental risks posed by wastewater, its use in urban and peri-urban agriculture is a reality," says Gayathri Devi of IWMI. "If the city were to impose policies that restrict urban agriculture, they would not only be largely ineffective, but they would also likely cause significant socioeconomic problems for farmers and their families." For instance, Hyderabad, India's sixth largest city, boasts an emerging Internet and biotechnology hub and is widely recognized as the meeting place of northern and southern India. But 300,000 farmers and their families working 15,000 hectares within the city continue to rely for food and income on a decidedly ancient irrigation system: water from the nearby Musi River that is little more than untreated waste for much of the year.[35]

Technologically savvy cities can see farms in and around the city as allies in keeping water coming into the city clean and ensuring that it is not too dirty when it flows out. In Lima, Peru, treated wastewater is used to produce tilapia, and studies show that fish cultured in this way are acceptable to consumers and economically viable. The construction costs for this lagoon-based wastewater treatment facility were charged to the municipality; the local farmers who irrigated their crops with treated wastewater were happy to pay the land and operation costs, which were half of what some of them paid for groundwater.[36]

All the attention that urban farming is receiving can make people more aware of local pollution. In Hanoi, Viet Nam, concerns about how industrial runoff, garbage, and poorly maintained canals were affecting the safety and flavor of fish from surrounding fish farms prompted municipal authorities to retain large wetlands and lakes within the city boundaries for aesthetic and flood control reasons. According to a recent report, fish farming "is encouraged by the authorities as they believe the residents of Hanoi will equate food production with good environmental health, thus providing reassurance to consumers."[37]

For cities confronted with growing waste disposal problems—which includes virtually all cities—the strongest environmental argument for local farming is the opportunity to reuse urban organic waste that would otherwise end up in distant, swollen landfills. (See Box 3–2.)[38]

People have kept livestock in cities for centuries to help deal with urban waste as well as provide income and food. Farm animals recycle household refuse, agricultural waste, lawn cuttings, and other organic matter very efficiently, and the manure they produce can improve urban soils. Despite the common assumption that all of the world's pigs, chickens, cows, and other livestock are raised in idyllic country settings, more and more of the world's meat and animal products are pro-

Box 3–2. Mining Organic Waste

Efforts to turn urban organic waste into compost have generally been small, limited to the efforts of a few farmers collecting food scraps from hotels or vegetable markets or enterprising individuals who have begun to "mine" city landfills for organic matter. It is estimated that in Kano, Nigeria, 25 percent of the fertilizer needs of nearby farmers are met with municipal wastes. Among the barriers to greater recycling of city wastes are a lack of people interested in collecting it, high transportation costs, and the fact that most urban waste systems mix organic (food scraps, leaves, grass clips, newsprint) and nonorganic (plastic, metals, glass, hazardous chemicals) waste, which complicates the removal of the organic component. In most countries, the cost of dumping waste into landfills is so low that there is little incentive to look for alternatives.

In settings where the organic waste is easily separated and where farm and garden plots are located nearby, the transformation of urban wastes into fertilizer can be a lucrative business, particularly for poor urbanites. Eduardo Spiaggi of the University of Rosario in Argentina is training residents of the city's *villas miserias* in composting techniques, since many of them already make a living from waste collection, classification, and recycling, although they often discard the organic part. In combination with training in small-scale gardening techniques, the participants—65–70 percent of whom are women—report more food for household consumption and some income from selling surplus food and compost.

For restaurants, hotels, supermarkets, and other businesses that generate large amounts of food waste, converting this "garbage" into compost can keep down disposal costs and even generate income. Projects from around the world have demonstrated the feasibility of collecting waste from an array of settings—supermarkets, restaurants, schools, hospitals—for composting on farms and spreading as fertilizer. In California, the Vons Companies Inc. and Ralph's Grocery Company supermarket chains, with more than 585 stores between them, have been able to reduce their waste stream by 85 percent and turned their scraps into profitable, branded products sold back to their customers.

SOURCE: See endnote 38.

duced in or near urban areas.

Consider this: People in developing countries now consume half of the world's meat, thanks to rising incomes and exploding urbanization. And people in cities in these countries are not just consuming more animal products, they are also becoming centers of production. In Bamako, Mali, for instance, 20,000 households keep livestock in the city. In Harare, Zimbabwe, more than one third of households keep chickens, ducks, pigeons, rabbits, and turkeys. In Dar es Salaam, Tanzania, 74 percent of people keep livestock, while in Dhaka, Bangladesh, the figure is 80 percent. Even in industrial countries people can be found raising bees, worms, chickens, and other animals. (See Box 3–3.)[39]

But there can be too much of a good thing. Thanks to unregulated zoning and subsidies that encourage large-scale livestock production, massive chicken and pig operations are moving closer and closer to major urban areas, including in China, Bangladesh, India, and many African countries. This, says Michael Greger, a veterinarian with the Humane Society of the United States, is "bringing together the worst of both worlds—the congested inner cities of the developing world combined with the congested environment on industrial farms."[40]

Box 3–3. Bees and Worms: A City's Smallest Livestock

Until mid-July 2005, dozens of people in Vancouver, Canada, were engaged in a sweet but illegal activity—raising bees. But thanks to a dedicated group of apiarists, the city's health council changed the laws, allowing beekeepers to manage their hives legally. In London, beekeeping is also now a legal endeavor, with at least 5,000 registered beekeepers keeping beehives in their backyards and on rooftops. Beekeepers in New York City, however, have not been as lucky. They are restricted by a law that prohibits raising "wild animals," including honeybees. That hasn't stopped beekeepers there from producing some of the best-tasting honey in New York State.

Consumers may be reluctant to try honey produced in polluted cities, but because many cities have a huge variety of parks, private gardens, and even outdoor flower stands, the honey produced in urban areas is just as good—or better—than that produced in the rural countryside. In addition to producing honey, bees help keep urban gardens pollinated and biologically diverse.

And while urban beekeepers carry out their work primarily on rooftops, a growing number of cityfolk are keeping their livestock under kitchen sinks, in backyard bins, and even huge municipal waste dumps. Vermiculture—recycling organic waste with worms—can be an environmentally friendly alternative to more conventional waste disposal. For households, worm composting bins take up very little space and work quickly. Worms typically eat their weight in food daily—a kilogram of worms can eat a kilogram of food waste every day.

Vermiculture can also be done commercially. While organic waste—everything from carrots to bread to yogurt—can take years to decompose in regular landfills, worms can compost up to 90 percent of waste in little more than a couple of months. Although some communities may have a hard time adjusting to separating their organic and inorganic waste, many have been able to do it successfully. The Canyon Conversions Company near San Diego in California (a city of about 150,000 people) processes some 400 tons of municipal yard waste per year with 200 tons of worms.

And in Rosario, Argentina's third largest city, residents of the poor Empalme Graneros neighborhood are using worm compost made from discarded fruit and vegetable trimmings to nurture plots of vegetables, while selling worms to local fishers. This income stream is no small benefit in the city with Argentina's highest unemployment rate. The residents sort trash and separate out plastics, cardboard, metals, and glass for resale. By recycling organic waste into compost, the project reduced the quantity of dumped organic waste that posed a health threat.

SOURCE: See endnote 39.

While there needs to be a place for raising animals in cities, industrial farming within cities is an inhumane and ecologically disruptive way of producing meat. A 2005 report by the World Bank echoed this, noting that the "extraordinary proximate concentration of people and livestock poses probably one of the most serious environmental and public health challenges for the coming decades." Many experts are worried about the spread of diseases, such as avian flu, from animals to humans, and city officials are grappling with how to dispose of mountains of manure.[41]

In many parts of the world, including along China's eastern coast, in Thailand around Bangkok, and in Brazil near São Paulo, there is an "excessive concentration" of factory farms as well as animal manure. In fact, some provinces along China's eastern seaboard, near consumers and port facilities, have more than 500 livestock per square kilometer, which is five times as many animals as

the surrounding land can handle.[42]

Even raising smaller herds of free-range livestock in cities can sometimes present waste management problems. In the city of Kisumu, Kenya, many residents rely on livestock for income and food. But there is little land available to absorb manure. According to a recent study, three fourths of the dung produced in Kisumu is not used as fertilizer for growing crops, nor is it a source of fuel for cooking and heating. And because there is no regular waste removal system in the city, the manure piles up and up, contaminating soil and water.[43]

But now some people living in Kisumu are using animal waste both as a source of fuel and as a money-making opportunity. With investment from Lagrotech Consultants, a private company, and from a development agency, Kisumu residents are turning dung into a safe, efficient source of fuel. The dung briquettes—made by mixing water, charcoal dust, straw, and other ingredients with animal manure—produce very little smoke (a health hazard of other fuels, particularly for women) and save residents from having to buy expensive commercial fuel. Livestock owners are also generating additional income by selling their excess briquettes.[44]

One way to prevent the problems that plague industrial livestock production is to discourage factory farming in or near cities. A recent FAO report suggests a combination of zoning and land use regulations, along with taxes, incentives, and infrastructure development that can encourage producers to raise animals closer to croplands, where manure can be used as fertilizer and where there is less risk of disease. According to FAO, figuring out where the best places are to produce livestock can help control land and livestock nutrient imbalances—in other words, raising livestock in areas that have enough land to handle waste. Thailand, for example, puts high taxes on large-scale poultry production within 100 kilometers of Bangkok, while giving farmers outside that zone tax-free status. Thanks to this, the concentration of poultry farms right outside of Bangkok has dropped significantly over the last decade.[45]

Planning Garden Cities

In the 1880s, Ebenezer Howard felt that the modern city was consuming itself and everything around it. Howard envisioned a different type of city, a "garden city," with parks and green spaces and suggested population and livestock carrying capacities. The city would include gardens to raise some of its own food, but it would also make room for deliveries of food from the nearby countryside. Howard realized that "people streaming into the city" not only represented a threat to the urban areas, it also could bleed the rural areas to death. He was not proposing a blending of the two into a homogenous suburb, but instead a symbiosis. "Town and country must be married," wrote Howard in *Garden Cities of To-Morrow*, "and out of this joyous union will spring a new hope, a new life, a new civilization."[46]

The remnants of Howard's garden city can be seen in greenbelt cities constructed during the Depression in the United States, in the postwar new towns of Great Britain, and in the parks that ring Portland, Oregon, today. Nonetheless, with few exceptions the marriage between town and country has not always been "joyous." The unchecked growth of modern cities, aided by freeways and mass transit that stretch ever farther from their core, remains one of the primary threats to the farmland that feeds them. As Howard suspected, the basic design of the modern city seemed to be inherently threatening to farming nearby. Rather than incorporating permanent farmland into urban design, planners pave it over, even as the growing urban pop-

ulation puts increasing demands on the remaining land. In the United States, 79 percent of fruit, 69 percent of vegetables, and 52 percent of dairy products are raised in metropolitan counties or fast-growing neighboring counties in the path of sprawl, which threatens to eliminate this form of urban agriculture.[47]

In Rosario, Argentina, seven farmers' markets and more than 800 community gardens sprouted up throughout the city.

Despite all that farming can do for the city landscape and the urban soul, politicians, businesses, and planners continue to regard food as a rural issue that does not demand the same attention as housing, crime, or transportation. This stubborn mindset partly explains the "piecemeal approach" to planning for city food systems, according to a study from the Department of Geography and Urban Planning at Wayne State University in Michigan. Urban planners around the world viewed gardens and farmland within city limits as an anachronism, not to be found in a "modern city." In many cities, farming has been outlawed. Policymakers would be wise to realize the nutritional, social, ecological, and economic benefits of reversing this mindset and putting programs in place to encourage cities to feed themselves.[48]

Planners interested in making room for farming in cities must look beyond farmers' markets and community gardens to much deeper issues of a city's design. An extensive light rail system that reduces the need for highways, or a municipal composting site that generates high-quality fertilizer, or city schools that serve local produce for lunch all represent important determinants of just how much a city can support the surrounding country.

Whether it is the English commonlands during the Middle Ages or the conservation reserves of today, keeping the countryside intact seems an essential ingredient in keeping urban life from destroying itself. Farmland is also less of a drain on public coffers than suburbs: research in the United States has shown that municipalities often spend several times more on public services for every dollar that new housing generates in tax revenue than they spend on services for every dollar generated by farms and open land. Advocates of farmland preservation point out that there is no shortage of creative policies at the disposal of interested municipalities. The scarce commodity has been the political will to confront powerful building and transportation lobbies.[49]

The location and design of food markets is vitally important for urban farming. In the absence of government leadership, the placement of food retailing outlets in cities is often haphazard and inefficient, and it ultimately ends up wasting food and driving up prices for poor consumers. For example, Edward Seidler of FAO's Marketing Group notes that of the five wholesale markets in Hanoi, a city of 5 million, only one was planned. The others all developed spontaneously and now find themselves deep in the inner city, where storage and waste disposal facilities are insufficient, food damage and losses are high, food quality is reduced, and traffic jams and parking are constant challenges for both buyers and sellers—all resulting in higher consumer prices. As many Third World cities begin to erect housing developments and transportation infrastructure to accommodate their rapidly growing populations, local officials who do not incorporate food shops and markets into their plans will force masses of residents to pay extra and travel long distances to buy food.[50]

Seidler suggests that city authorities consider establishing local retail markets that cater to low-income consumers, while simul-

taneously providing outlets for farmers, especially those who grow vegetables on the edge of cities. "In Dar es Salaam and Mbabane and Manzini in Swaziland, the local councils have established small retail markets to serve local clientele living in the suburbs," Seidler notes. "In Barbados and in many Caribbean countries, local councils have established small retailing facilities around local bus stops to provide services to hawkers who formerly sold their produce, exposed to the elements, on pavements blocking pedestrian traffic."[51]

In Rosario, Argentina, where farming in the city was initially a response to the nation's financial crisis, officials are trying to establish it as an integral part of urban life. They created the Programa de Agricultura Urbana (PAU), a cooperative venture that unites urban farmers, municipal officials, agricultural experts, and representatives of nongovernmental organizations. The PAU helped urban farmers secure and protect agricultural spaces, take advantage of value-added agricultural products, and establish new markets and market systems. Soon, seven farmers' markets and more than 800 community gardens—supporting some 10,000 farmers and their families—had sprouted up throughout the city. The cooperative also involved residents of Molino Blanco, a low-income housing project, in the design and construction of a large garden park that includes walking paths, soccer fields, and large designated areas where people can raise food.[52]

"Urban farmers tell me that they are not only pleased to have the opportunity to generate income and feed their families," said Raul Terille with the Centro de Estudios de Producciones Agroecologicas in Rosario and a member of the PAU. "But also, after years of feeling marginalized, they are making a genuine contribution to their city and are finally being recognized for it."[53]

From Cienfuegos in Cuba to Piura in Peru and Dar es Salaam in Tanzania, city officials are also taking inventories of available vacant land in the city through on-the-ground surveys by farmers and through geographic information systems and are analyzing the land's suitability for agricultural use. In a few cases, officials then demarcate certain areas to be permanently used for farming, which gives farmers the incentive to make long-term investments in the land.[54]

In the erosion-prone city of Villa María del Triunfo in Peru, where 83 percent of all urban farmers are women for whom this is the sole source of income, city officials surveyed the 70-square-kilometer urban landscape to determine what share was suitable for farming. By 2004 the municipality had established a dedicated urban agriculture office in its economic development branch; had earmarked money to subsidize seed, fertilizer, and other inputs for city farms; and encouraged an increase in local processing and marketing. The program helped create 399 family and community plots on formerly vacant land, examined sources of irrigation water, developed a municipal consolidation plan for urban agriculture through 2010, and formed a multistakeholder advisory group that supports ongoing implementation of the plan.[55]

Mapping can be used not just to find suitable farmland but also to track food availability, as the city of Philadelphia in the United States did several years ago. It found that a lack of healthy food options and high rates of diseases like cancers, diabetes, high blood pressure, and heart disease coincided in the low-income areas of the city. The Food Trust's Supermarket Campaign leveraged this information to create the Pennsylvania Fresh Food Financing Initiative, an $80-million public-private partnership that works to increase the number of grocery stores in underserved communities. Penn State University researchers are using National Institute

of Health money to study the effects of this initiative on fruit and vegetable consumption patterns and on health.[56]

If the goal is to be more self-sufficient when it comes to food, city officials need to think creatively. Perhaps the most cutting-edge design innovation for bringing food back into cities is also the most sublime—rooftop gardens. At the midtown-Manhattan headquarters of Earth Pledge, an environmental organization hoping to lower New York City's temperature and reduce pollution, a green roof with an organic kitchen garden—filled with lettuces, tomatoes, eggplants, peppers, cucumbers, assorted herbs, and even sweet potatoes—thrives above the shade created by the skyline and is out of the way of ground-level pollution from cars.[57]

Rooftop gardens are springing up everywhere. City Hall in Chicago sports a green roof; in Tokyo, a new ordinance requires all new building plans with more than 1,000 square meters of floor space to cover 20 percent of their roofs with vegetation as a way to reduce energy costs and urban temperatures. (See also Chapter 5.) In Mexico, the Institute for Simplified Hydroponics has developed low-cost roof garden technologies that will help many more landless peasants in the world's expanding cities feed themselves and earn a living from urban farming. And in Morocco, students and community groups have built garden beds from old tires filled with compost and vermiculite on rooftops and achieved yields dramatically greater than conventional gardening. They collected and recycled water that drained through the bottom of the beds, reducing water use by 90 percent over standard gardening techniques—a critical factor for countries susceptible to drought.[58]

In some cases, urban food policy councils have been formed to help guide government decisions on food. These informal coalitions of local politicians, hunger activists, environmentalists, sustainable agriculture advocates, and community development groups allow food policy decisions to reflect a broad range of interests and tap possible synergies. For instance, hunger activists, senior citizens, and farmers might join to lobby for farmers' market coupons for the poor and elderly, so that hungry citizens could buy healthy food and farmers would have new customers.[59]

The Hartford Food System (HFS), for example, works to give people in Connecticut better access to nutritious and affordable food. The group has helped establish farmers' markets, distributes coupons to low-income households for use at these markets, created a grocery delivery service for homebound elderly people, and launched the Connecticut Food Policy Council—a body that helps guide Connecticut's decisions about food. HFS tracks prices at supermarkets and operates a 400-member community-supported agriculture program that distributes 40 percent of its produce to low-income people. It also educates the public about farmland preservation and lobbies for policies that preserve farmland.[60]

These local councils might have another policymaking advantage. "Only an entity on the ground that knows the community and knows the nuances of the local food system knows how to make the system work for local folks," says Mark Winne of HFS. Policies designed in the rarefied air of bureaucracies may not be relevant or effective for specific cities or communities. HFS interviewed hundreds of low-income Hartford residents to determine the main causes of hunger in the city. After finding a strong correlation between frequent bouts of hunger and poor access to transportation options, the group worked with city officials to modify bus lines so that routes connected low-income communities with supermarkets. HFS also helped to open

several farmers' markets and a new supermarket in the same poorly served area.[61]

Without public participation, policies intended to support urban farming might actually harm it. In the 1980s, the government of Tanzania issued a policy encouraging people in cities to grow food. This policy built on years of farming and cattle raising in Dar es Salaam and other cities during colonial times. Much of that cow grazing, though, was in less populated parts of the cities owned by wealthy foreigners. The new policy meant animals were in the densest part of the cities, creating noise and manure problems.[62]

Bombarded with complaints, the city government in Dar es Salaam responded by being stricter about noise, dirt, and manure cleanup. Between 1985 and 2005, the number of animals kept in the city quadrupled, growing faster than the human population did, but the number of problems reported plummeted. The amount of land under cultivation has doubled, hundreds of jobs have been created, and the availability of locally grown food has increased dramatically. Women who keep cows or raise vegetables in their backyards report making two to three times as much per year as their husbands, inspiring people elsewhere in society. "Once national and municipal leaders understood the on-the-ground reality of urban agriculture, they were convinced of its economic value—especially for poor families and women," says George Matovu, Regional Director of the Municipal Development Partnership in Tanzania.[63]

One way to make it easier for cities to feed themselves is to slow the flow of people into them from the countryside. Policymakers in rural areas have to make living there a healthy, viable option for the world's poor, so that they are not forced to move to cities. In just the last 50 years, some 800 million people have moved from the countryside to urban areas in search of higher incomes and a better way of life.[64]

Investing more in rural agriculture can help ease this migration, according to a 2006 study by FAO. The report found that governments and policymakers are largely unaware that if "properly managed," agriculture can not only produce food but also have a positive impact on poverty alleviation, food security, crime control, and protection of the environment in both cities and the countryside. In particular, improving roads and rural infrastructure, access to credit, and social services in rural areas can help curb the rate of people leaving the country and ease pressure on urban centers. People leaving the country often gravitate to a nation's capital or a few large cities, a strain that can be lifted by medium-sized towns that embrace urban agriculture as farming and farming-related industries flourish.[65]

The most cutting-edge design innovation for bringing food back into cities is also the most sublime—rooftop gardens.

A low-cost option for growing food in cities might be even more important than ever before. The migrations that prompted Ebenezer Howard to demand a new pattern of city development are minuscule compared with the changes under way in the Third World today. "On the longer term, urban agriculture will be sustainable especially if its potential for multifunctional land use is recognized and fully developed," noted René van Veenhuizen, editor of *Cities Farming for the Future* by Resource Centers on Urban Agriculture and Food Security. "The sustainability of urban agriculture is strongly related to its contributions to the development of a sustainable city: an inclusive, food-secure, productive and environmentally healthy city."[66]