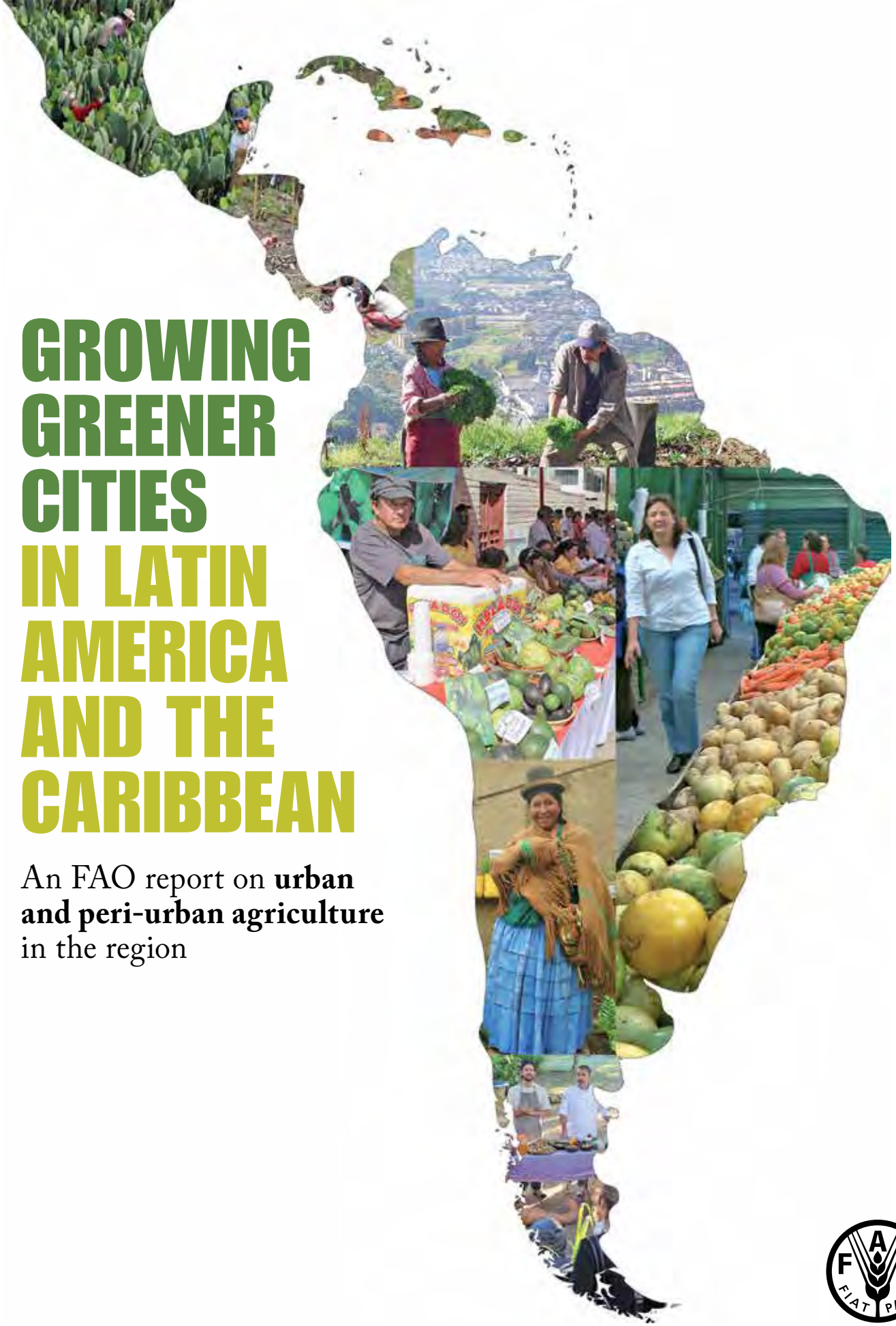

GROWING GREENER CITIES IN LATIN AMERICA AND THE CARIBBEAN

An FAO report on **urban and peri-urban agriculture** in the region

GROWING GREENER CITIES IN LATIN AMERICA AND THE CARIBBEAN

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FAO's Director-General visits a family garden in Tegucigalpa in July 2012

On a visit to Tegucigalpa, I went to one of the city's poorest informal settlements to see an FAO project that was training women to grow food crops in their backyards. As we climbed slopes lush with cassava, maize and cabbages, they told me how the gardens had changed their lives – by providing their families with fresh, nutritious food and helping them to earn extra income selling surpluses. I met urban farmers like them on the outskirts of San Salvador, where FAO has helped the Government set up a centre to teach women ecological farming techniques adapted to small spaces. In Managua, I saw prolific gardens of tomatoes, sweet peppers and spinach irrigated by an ingenious system of recycled plastic bottles. In Havana, I visited a farm just outside the city that produces 300 tonnes of vegetables a year, with no chemical inputs.

In all of those cities, common people are leading a quiet revolution known as "urban and peri-urban agriculture", or UPA. In recent years, FAO has strongly supported the development of UPA in Latin America and the Caribbean, in cities from Port-au-Prince to El Alto on the Bolivian *altiplano*, through initiatives that involved national governments, city administrations, civil society and non-governmental organizations. That groundwork has been rewarded with widespread recognition – highlighted in this report – of the important role of urban and peri-urban agriculture in sustainable urban development.

The report presents urban and peri-urban agriculture in 23 countries and 10 cities. It shows that UPA is crucial to the food and nutrition security of poor households in many cities of the region, supplies urban dwellers with fresh, high-value "local food", generates employment, creates greenbelts that improve the quality of urban life, and stimulates local economic development.

What's more, when facilitated by government, integrated into city and regional planning, and supported by action to promote sustainable production, improve food delivery, and ensure food quality and safety, UPA is a key component of robust and resilient urban food systems. For example, a growing number of cities in the region are linking family farmers in peri-urban and adjoining rural areas to their food banks, school meals and other food and nutrition security programmes, contributing to the livelihoods and well-being of both the rural and urban poor.

The food producers of Tegucigalpa, San Salvador, Managua and Havana, and other common citizens of Latin America and the Caribbean, are helping to build the greener, more resilient and sustainable cities of the future.

José Graziano da Silva
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Overview

In October 2009, representatives of governments, research institutes, NGOs and international organizations from 12 countries in Latin America and the Caribbean met in Medellín, Colombia, to develop strategies to end high rates of urban poverty and food insecurity across the region.

THEY MET AS MANY COUNTRIES were emerging slowly from the effects of global fuel and food price inflation, which had pushed the cost of living beyond the resources of many of the region's 160 million urban poor. The hardest hit were urban families in Caribbean countries with a high dependency on food imports, and those in countries with high levels of extreme urban poverty, where food purchases account for most of low-income households' spending.

The Medellín meeting proposed an urban transition toward social inclusion, equity and sustainability. Its Medellín Declaration urged national, state and local governments to incorporate *urban and peri-urban agriculture,* or UPA, into their programmes for eradicating hunger and poverty, ensuring food and nutrition security, promoting local development and improving the urban environment.

At the time, UPA was providing a safety net for many low-income families. A recent FAO analysis of national household surveys collected between 2003 and 2008 shows that 1.4 million urban dwellers in Nicaragua and Guatemala were also food producers. Savings made on food purchases, along with sales of produce, accounted for more than one-fifth of their household income.

Five years later, this report looks at progress toward realizing Medellín's vision of "greener cities" in Latin America and the Caribbean – ones in which UPA is recognized by public policy, included in urban development strategies and land-use planning, supported by agricultural research and extension, and linked to sources of technological innovation, investment and credit, and to urban markets and consumers.

Since 2009, the urban population of Latin America and the Caribbean has increased by some 50 million, to almost half a billion. The region is now the most urbanized in the world, with 80 percent of its people living in towns and cities. Almost 70 million are concentrated in four megacities: Buenos Aires, Mexico City, and Rio de Janeiro and São Paulo in Brazil.

While the proportion of slum dwellers in the urban population has fallen, their total number grew to more than 110 million in 2010. Urban poverty rates remain unacceptably high – 30 percent of urban residents in Colombia, 35 percent in Guatemala and 24 percent in Paraguay were living below the national poverty line in 2011.

And the spectre of urban hunger has not been beaten. A recent World Bank study found that higher food prices are "here to stay" in Latin

America and the Caribbean. The negative impacts of future price increases, the Bank says, are likely to be felt mainly by the urban poor.

The United Nations Human Settlements Programme (UN-HABITAT) believes that Latin American and Caribbean cities have the chance to escape from underdevelopment, inequality and unsustainability. Following 50 years of rapid growth, the process of urbanization is "virtually completed" in all countries.

Now, says UN-HABITAT, the region needs to create urban centres that are environmentally sustainable, promote social inclusion, favour local employment, and reaffirm the primacy of public spaces. A starting point for that transformation is urban and peri-urban agriculture.

The Food and Agriculture Organization has actively promoted UPA since 1999, when it reported that 800 million people worldwide were engaged in crop, livestock, fisheries and forestry production within and surrounding urban boundaries. Since then, the urban population in the world's less developed regions has grown from 2 billion to more than 2.7 billion.

Along with population growth, and the rising challenges of climate change and the depletion of natural resources, concepts of UPA have evolved. Food production in urban and peri-urban areas is now seen as integral to resilient and sustainable "city region food systems" that are incorporated fully into development planning.

As well as providing the urban poor with nutritious food and extra income, UPA has become a key part of strategies for reducing cities' ecological footprint, recycling urban wastes, containing urban sprawl, protecting biodiversity, building resilience to climate change, stimulating regional economies, and reducing dependency on the global food market.

To assess the state of urban and peri-urban agriculture in Latin America and the Caribbean, FAO conducted a survey in 2013 in 27 countries; completed surveys were received from 23 of them (*listed on page iv*). FAO also commissioned case studies on agriculture in and around 13 of the region's major cities*.

Data was provided on agriculture in 110 cities, municipalities and towns, ranging from major urban agglomerations, such as Mexico City, to the community of San José del Golfo (population: 5 889) in Guatemala; from the prosperous regional capital of Belo Horizonte, in Brazil, to overcrowded camps of displaced people on the outskirts of Port-au-Prince.

FAO's inquiry has confirmed that UPA is widespread in the region. It is practised, for example, by 40 percent of households in Cuba, and 20 percent in Guatemala and Saint Lucia. In the main cities and municipalities of the Plurinational State of Bolivia, 50 000 families are also food producers. In Bogotá, 8 500 households produce food for home consumption. In Haiti, 260 ha of land in and around Port-au-Prince and other towns are cultivated by 25 500 families.

Among capital cities, the "greenest" is Havana, where 90 000 residents are engaged in some form of agriculture, whether backyard gardening or working in the city's commercial gardens and on livestock farms. Quito also stood out: at last count, the city had 140 community gardens, 800 family gardens and 128 school gardens.

Urban agriculture in the region encompasses a wide range of activities suited to small spaces, from backyard vegetable gardening to intensive production of flowers and the raising of small animals for eggs and meat. School gardens and backyard family horticulture are the dominant forms of urban food production.

Family gardens are common in urban areas of Cuba, Colombia, Nicaragua, Ecuador and Peru, and in most Caribbean countries. They produce eggplant and okra in Antigua and Barbuda, carrots and coriander in Tegucigalpa, broccoli and quinoa in Quito, and spinach and strawberries on Bolivia's *altiplano*.

In Bolivian cities, families also raise guinea pigs, which fit easily into small spaces and are a good source of protein. In Mexico City suburbs, residents keep rabbits, birds and sheep. In Kingston's inner city, youths breed tropical fish for export to North America.

Urban farmers come from all age groups and walks of life. But most are from low-income households, and they take up farming as a means of reducing their spending on food and making extra income from sales. In 16 of the 23 countries surveyed, people practising UPA earned some income from the activity.

The main benefit, however, was improved access to food. Urban food producers and their families enjoyed a more diverse diet than other urban dwellers, and were more likely to consume fruit and vegetables regularly.

Women are the driving force behind urban agriculture in many countries, and particularly in the Caribbean, Bolivia, Colombia, Ecuador, Honduras and Nicaragua. A high proportion of urban farming families are female-headed: 90 percent in Managua, 86 percent in Haiti, 70 percent in Belize City and 25 percent in Quito.

The main challenge facing farmers in the cities surveyed was lack of space, followed by the poor quality of soils and the unreliability of water supplies. For those interested in producing bigger surpluses for sale, the main constraints were the high cost of inputs, the lack of quality seed, and the unavailability of credit needed for buying tools and processing equipment. But higher yields were no guarantee of higher earnings – most producers had very limited access to markets.

In city region food systems, agriculture in peri-urban areas and rural areas is critical to the supply of food to urban centres, and contributes to employment, livelihoods, nutrition and environmental resilience. The city region scale is seen as a sustainable, manageable spatial unit for integrating food production with other ecosystem services and providing social protection for the rural and urban poor.

In Latin America and the Caribbean, peri-urban agriculture includes large farming areas that produce cereals, vegetables and root crops, grazing land for goats and sheep, dairy farms, and intensive livestock production units. Some 22 800 ha of farmland within the bounds of Mexico City produce annually around 15 000 tonnes of vegetables. On the outskirts of Lima, short-cycle vegetables are grown on some 5 000 ha of irrigated land for sale in the city's markets. Small-scale farming is a source of income for settlers from rural areas and many of Lima's urban poor.

Despite its role in creating employment and feeding cities, peri-urban agriculture is under increasing pressure from urbanization itself. In Argentina, the production of soybean for export has displaced peri-urban production of milk, fruit and vegetables.

In Mexico City, informal settlements are spreading on land reserved for agriculture, and the overexploitation of aquifers by domestic and industrial users has caused a serious decline in

* FAO will publish a detailed analysis of the survey data and a compendium of the case studies in 2014.

the supply and quality of water. Small farmers have limited access to the city's markets; they lack processing technologies needed to add value to their produce, and are exposed to health risks from the overuse of agrochemicals.

In Lima, intense competition for water forces most farmers to irrigate with highly polluted wastewater. Urban sprawl has taken out of production some of the Province of Lima's best farmland, and is pushing agriculture into more distant and less fertile areas, which will lead to longer distribution channels, higher food prices and shortages of some produce.

Growing greener cities with agriculture needs the support of government, from national to local levels. Governments set urban development policies and priorities. As major landowners and managers of solid wastes and water supplies, they can provide – or deny – the resources needed for UPA. We examine here the extent of political and institutional commitment in the region, and what that support means for urban and peri-urban agriculture "on the ground".

Twelve of the 23 countries surveyed have national policies that explicitly promote UPA. Eight of them are in the Caribbean. Cuba's policy dates back to 1997, when the government decided to promote urban agriculture nationwide. Its UPA programme has established in Havana a network of agricultural supply stores, municipal seed farms, composting units and veterinary clinics. Urban farmers are entitled to agricultural insurance and production loans.

In Brazil, support to UPA is part of the national Zero Hunger policy. Implemented with local authorities, it includes the building of farmers' markets, training for school gardeners, the allocation of vacant urban spaces for agriculture, and reduced taxes on land used for the purpose.

Then there are countries with *no* policy on UPA, including some – Colombia, Ecuador and Peru – which have large urban populations and active urban agriculture programmes in their capitals, Bogotá, Quito and Lima.

Even in the absence of a national policy, however, UPA has been mainstreamed at a fairly high level within national institutions. While Bolivia has yet to adopt its draft National Food and Nutrition Policy – which is expected to endorse urban and peri-urban agriculture – the country's Ministry of Productive Development and Plural Economy will launch, with FAO's assistance, a national UPA programme in 2014.

Out of 26 countries for which information is available, 17 have at least one government ministry charged with regulating, facilitating and supporting UPA. In the Caribbean, a national ministry, usually the Ministry of Agriculture, is responsible for the sector in 11 of the 12 countries surveyed. In Antigua and Barbuda, support to backyard gardening includes the services of eight extensionists and six community facilitators, and the supply of seeds, seedlings, fruit trees and inputs, free of charge or at minimal cost. In Guatemala, the Ministry of Agriculture, Livestock and Food has created a Department of Urban Agriculture, which provides producers with training, tools and inputs.

In some countries, UPA is promoted by national research institutions. Argentina's *Pro-Huerta* gardening programme has been operational for more than 20 years under the National Institute of Agriculture and Livestock Technology, and has helped to establish 8 000 community gardens and half a million family gardens.

But the real test of political and institutional commitment must be at the city level. In Caribbean countries, it is national government institutions that regulate and support agriculture in urban areas, which is to be expected, given the small size of most Caribbean island states.

In Cuba, Guatemala and Nicaragua, the task is shared between national, provincial and local authorities. In Rosario, Argentina, the city government allocates 25 agronomists and US$380 000 a year to its agriculture programme, while *Pro-Huerta* provides training, seeds and tools and Santa Fe Province funds the installation of infrastructure.

Belo Horizonte's Urban Agriculture Support Policy recognizes UPA as contributing to "the full development of the social functions of the city". The local government invests $240 000 a year to promote food production, with support from the state agricultural extension service. UPA development is guided by a Council for Food Security, which includes representatives of municipal, state and federal governments.

Local government, at different territorial and administrative scales – from parish and municipality to district and province – is responsible for UPA in Bolivia, Colombia, Ecuador, El Salvador, Haiti, Honduras, Paraguay and Peru. Many cities have mandated specialized agencies to manage and support UPA activities in their jurisdictions. In Quito, it is the municipal agency for economic development, which provides subsidized inputs and helps to develop urban gardeners' management skills.

Several municipalities on the outskirts of Guatemala City have their own home gardening programmes. Municipalities, often working with NGOs, are also the main promoters of UPA in El Salvador and Honduras. El Alto's municipal government has adopted as a public policy the promotion of agricultural and livestock production in its urban and peri-urban areas.

Provincial and district governments have responsibility for UPA in Peru. The Metropolitan Lima Municipal Council adopted in September 2012 an ordinance which establishes an urban agriculture programme. However, many local administrations have no policy or programmes for agriculture.

Why do some cities embrace UPA and some not? Among factors favouring UPA development is the involvement of international organizations, such as FAO and UN-HABITAT, and international NGOs, such as the Resource Centres on Urban Agriculture and Food Security (RUAF Foundation) and the Institute for the Promotion of Sustainable Development (IPES).

Between 2004 and 2011, a multidisciplinary Urban and Peri-urban Agriculture Group, based in FAO's Regional Office for Latin America and the Caribbean, promoted UPA development across the region. It organized high-level meetings of policymakers and launched projects in Argentina, Bolivia, Brazil, Colombia, Ecuador, Guatemala, Honduras, Nicaragua, Uruguay and Venezuela which generated knowledge and tools that are used today in the design of UPA strategies and programmes, and in training and technology transfer. The regional UPA initiative also produced a series of radio programmes and educational videos, an on-line capacity-building course, and practical manuals on subjects including gardening, simplified hydroponics, seed production and biological pest control.

Local NGOs can stimulate local UPA. Rosario's programme grew out of an NGO initiative that introduced gardening in slums. The political will of individuals can also be decisive: programmes

for urban agriculture in Belo Horizonte and Bogotá were initiated by mayors elected on platforms of food security and inclusive socio-economic development.

Sometimes, the positive results of city initiatives can influence national policy. The success of FAO-supported backyard gardening projects in Managua and Tegucigalpa helped persuade the Governments of Nicaragua and Honduras to "up-scale" urban agriculture to national level.

Following the 2007–2008 food crisis, a United Nations high-level task force called for a paradigm shift in urban planning, to one that encourages urban and peri-urban food production. Zoning land for agriculture is one recommended measure – it protects land from competing uses, and can help establish urban farming as an economic activity and urban farmers as a professional category.

FAO's survey found that UPA is often excluded from – or not explicitly included in – city land use planning and management in Latin America and the Caribbean. That was the case in Antigua and Barbuda, Chile, Colombia, Dominica, Ecuador, Dominican Republic, El Salvador, Guyana, Honduras, Jamaica, Panama and Paraguay. In another five, no information was available.

Only Cuba, Guatemala and Peru confirmed that UPA is included in the land use plans of at least some cities or municipalities. In Guatemala, the municipality of Palencia has recognized backyard gardening in its development plan. In Peru, local governments in three of Lima's districts have incorporated agriculture in their planning, sometimes for civic beautification.

Crop and animal production is recognized as a legitimate land use in Havana's strategic plan, which allows agriculture in areas where construction is not foreseen. The city's Urban Planning Office conducts an impact evaluation of all proposals for UPA-related activities, requiring, for example, that large vegetable gardens harmonize with their locations.

In Argentina, Rosario's land use plan makes specific provision for the agricultural use of public land, and the municipality is building a "green circuit" of farmland passing through and around the city. Food production is also recognized as a legitimate non-residential land use, on a par with commerce, services and industry, in Belo Horizonte.

But urban planners are far still behind UPA in many cities, even some with long-standing UPA programmes. While Quito's new development plan envisages an equitable, sustainable and participatory city with full employment and a diversified economy, it makes no mention of urban agriculture.

Peri-urban agriculture also needs protection from unplanned urban growth. To safeguard its supply of drinking water – and oxygen – Mexico City has classified more than half of its total land area as a protected *suelo de conservación,* which includes 300 sq km of farmland. However, efforts to promote sustainable agriculture in suburban and peri-urban areas are stymied, not only by illegal settlements, but also by small-scale farmers' lack of secure land tenure.

A strong trend in many UPA programmes in Latin America and the Caribbean is toward agricultural technologies and practices that produce more, and better quality, food while optimizing the use of natural resources and reducing reliance on agrochemicals.

In Havana, the use of synthetic fertilizer and pesticide is prohibited by law. To keep soil healthy, the UPA programme provides green manure and vermicompost, and links gardeners to sources of manure, household wastes and agro-industrial residues for making compost. Havana's gardens are so productive and cost-efficient that the national Ministry of Agriculture promotes agro-ecological production in rural areas as well.

Vegetables are 100 percent organic in Rosario, where gardeners cultivate high-yielding beds of compost substrate. In Managua, they enrich the soil with fertilizer made by anaerobically fermenting household wastes, and combat whiteflies with sticky traps.

In Tegucigalpa, the FAO-supported project promoted low-cost gardening technologies that were easy to implement using local inputs. Because soil quality is more easily enhanced in small spaces, various containers were tested to optimize production. The preferred containers were old tyres, which gardeners found higher yielding and easier to irrigate. In El Alto, a project installed, in small, locally made greenhouses, hydroponic gardens that produce 40 kg of tomatoes per square metre a year.

FAO has promoted various technologies that conserve water. In Managua, the answer to dry season water shortages was a rooftop rainwater harvesting system, which channels run-off during the wet season to a 5 000 litre storage tank. In El Alto, the use of surface mulch and drip irrigation reduced water needs by 80 percent. In Tegucigalpa, many women use old tyres filled with gravel to purify kitchen greywater, and re-use it on their gardens.

When appropriately treated, wastewater from domestic sources is safe to use on crops and contains nutrients that increase yields. Lima's abundant supply of wastewater could soon be put to good use in its peri-urban farming areas. Thanks to two new sewage treatment plants, 100 percent of the Lima's effluent will be treated by the end of 2014. That opens the way for the re-use of the city's liquid and solid wastes on some 10 800 ha of farmland, which would increase production and create jobs.

Animal production can also be made safer and more productive. A district office for urban agriculture in Lima trained pig farmers in good production practices, such as vaccinating their animals, improving their diet, safely disposing of wastes and building concrete sties. The farmers have recently begun converting pig manure into biogas and selling it to urban residents.

Although Mexico City prohibits the use of agrochemicals on its peri-urban farmland, enforcement is weak because responsibility for compliance is placed on the farmers, not the suppliers. A transition to sustainable agriculture also requires more efficient management of urban organic wastes for composting, and increased capacity for the treatment of wastewater for irrigation.

To realize UPA's full potential for generating income, stimulating economic development and delivering food that is safe and of good quality, producers need access to markets and technologies that add value to their produce.

FAO's survey and city case studies indicate that many people practising UPA for home consumption also sell surpluses. The proportion of "commercial producers" was 26 percent in Antigua and Barbuda, 40 percent in Cuba, 54 percent in Bolivia and 68 percent in Dominican Republic.

Cities with successful UPA programmes usually have well-organized marketing systems. Havana has fruit and vegetables sales points located

within 5 km of production units and throughout the city's urban neighbourhoods, where producers sell directly to consumers. In 2013, sales amounted to 26 500 tonnes.

Another trend in Latin American cities is the spread of farmers' markets that sell locally-grown organic food. Quito has 14 one-day *bioferias,* open weekly and located in low-income areas as well as in better-off neighbourhoods. In 2012, they sold more than 100 tonnes of produce worth US$176 000.

In Rosario, too, vegetables are sold at "agrochemical-free vegetable fairs" in all six of the city's districts. Rosario's vegetables are certified as organic by a system of "social certification", guaranteed by the municipality, the city gardeners' association, *Pro-Huerta* and a local NGO that promotes fair trade. The UPA programme in Quito is registered as a producer and marketer of organic produce at national level.

Belo Horizonte municipality plans to open in the city centre a weekly "urban agriculture fair" for direct marketing by farmers who have converted to organic production. The municipal government also provides 30 sales points where rural farmers sell each year some 700 tonnes of leafy vegetables, fruit and root crops.

Post-harvest processing adds value. In Antigua and Barbuda, some backyard gardeners sell fruit drinks and sun-dried hot peppers. As urban food producers achieve household food security in Quito, the city's agriculture programme encourages them to form microenterprises, and trains them in business planning, marketing and accounting. Urban farmers there have entered the value chain as intermediate or final processors of meat, canned goods, dairy foods and snacks.

The urban agriculture programme in Rosario has created three "social agro-industries" that prepare vegetable trays and baskets, and make pie fillings, soups, jams and sweets. In El Alto, 70 families, trained in post-harvest handling and packaging, now sell their vegetables under the brand name, "Verdurita", in the capital, La Paz.

Many urban and peri-urban farmers have been tapped as suppliers of institutional feeding programmes. In Havana, UPA provided in 2013 some 6 700 tonnes of food to almost 300 000 people in schools, public health centres, hospitals and other institutions in the city. Urban, peri-urban and rural agriculture contribute to Belo Horizonte's multiple programmes for food and nutrition security. A third of the food in the 46 million meals prepared annually for its school feeding programme is procured from family farmers in the metropolitan region's rural areas.

The international community is developing a global development agenda beyond 2015, with sustainable development at its core. As part of that process, all stakeholders have been invited to participate in setting Sustainable Development Goals (SDGs), to be agreed by the United Nations General Assembly.

There is a general consensus that the SDGs should include: eradicating hunger and poverty, increasing agricultural production sustainably and improving food systems, and building sustainable cities that provide food security, economic opportunity and a healthy environment, and have strong links to peri-urban and rural areas. The city region food system offers a point of convergence for achieving all of those goals.

HAVANA

Following the 1959 revolution, Cuba launched agricultural development programmes that made intensive use of agrochemicals and farm machinery. By 1980, when its population reached

10 million, the country was able to produce food for 40 million people. Cuba was also one of the world's major producers of sugar, with annual exports of more than 550 000 tonnes. The collapse of the Soviet Union in 1991 deprived Cuba of its main trading partner and source of fossil fuel. That, and the United States' trade embargo, ushered in what Cubans call the *período especial*, an extended economic crisis which led to food rationing and rising rates of malnutrition. With agriculture affected by shortages of fuel and of two key petroleum derivatives, mineral fertilizer and pesticide, Havana residents began planting food crops wherever space was available. At first, yields were low, owing to lack of farming experience and inputs. But with strong government support, urban agriculture was rapidly transformed from a spontaneous response to food insecurity to a national priority. In the process, Havana has added a new word – *organoponics* – to the urban agriculture vocabulary, and has also become a pioneer in a worldwide transition to sustainable agriculture that produces "more with less".

INTENSIVE VEGETABLE PRODUCTION in Havana began in the 1800s, when Chinese immigrants started market gardens on the city's outskirts. But the foundation of today's flourishing urban and peri-urban agriculture movement can be traced to a precise date: 27 December 1987, when the Central Committee of Cuba's Communist Party called for action nationwide to promote intensive horticulture, using a technology known as "organoponics".

Organopónicos is a Cuban invention. The term was coined to distinguish it from other intensive, high-yielding horticulture production systems, such as hydroponics, which grows plants on water and inert substrates that have been enriched with mineral nutrients.

While Havana's urban farmers have experimented with hydroponics, that technology depends on a reliable supply of chemical inputs. The Cubans called their solution organoponics because it uses an organic substrate, obtained from crop residues, household wastes and animal manure.

With the onset of the *período especial*, organoponic gardens proved ideal for growing crops on poor soils in small urban spaces. A typical organoponic garden is started by making furrows in the soil, then lining the rows with protective barriers of wood, stone, bricks or concrete. The soil quality is gradually improved through the incorporation of organic matter; as organic content increases, so do the levels of soil nutrients and moisture (and the height of the bed).

Organopónicos – the term applies to both the technology and the garden – can be applied on building sites, vacant lots and roadsides, and arranged in terraces on sloping land. Soil can be tailored, using specific mixtures, to specific crops. If the soil is affected by nematodes or fungi, the entire substrate can be replaced. If necessary, the gardens can be disassembled and relocated.

With drip irrigation, regular addition of compost and good horticultural practices – such as the use of well-adapted varieties, mixed cropping, crop rotation and integrated pest management – the raised beds can produce vegetables all year round, and achieve yields of up to 20 kg per sq m.

In 2013, Havana counted 97 high-yielding organoponics, which produce vegetables such as lettuce, chard, radish, beets, beans, cucumber, tomatoes, spinach and peppers. Among the best

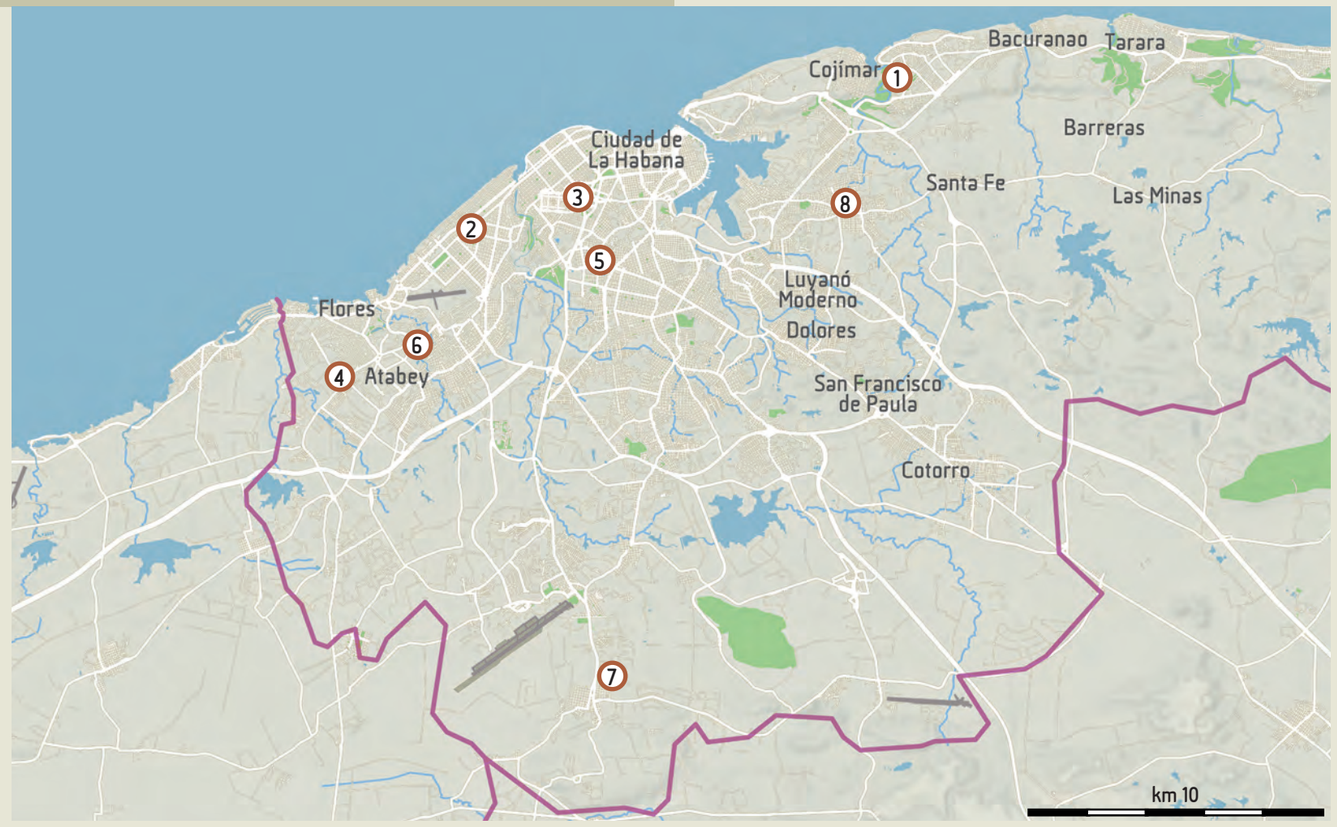
NEILJS

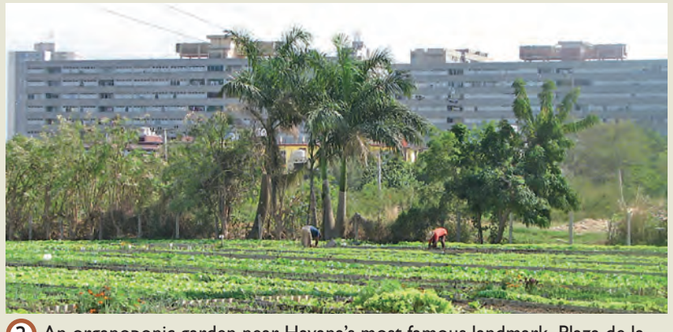
IN BRIEF: HAVANA

Havana is synonymous with urban agriculture. Supported by a network of seed farms, composting units and veterinary clinics, its farmers produce more than 60 000 tonnes of vegetables and 1 700 tonnes of meat a year.

1 The gardens of Vivero Alamar, which was created on abandoned waste land 8 km east of the city centre in 1997.

2 Concrete barriers line an organoponic garden on 5th Avenue, in the municipality of Playa, western Havana.





3 An organoponic garden near Havana's most famous landmark, Plaza de la Revolución, produces lettuce, chard, radish, beets, beans, cucumber, tomatoes, spinach and peppers.

4 On the corner of 23rd Avenue and 222nd Street, in the municipality of La Lisa, urban gardeners buy seed at one of Havana's 52 agricultural stores.

5 Vegetables and herbs growing on a "green rooftop" in Cerro, one of the city's oldest municipalities.

6 A stall sells fresh, locally grown fruit and vegetables near Havana's Ciudad Libertad airport, in the municipality of Playa.

7 This garden in Reparto Porvenir, in the municipality of Boyeros, produces vegetable seedlings in root balls, ready for transplanting.

8 Inside a park in the municipality of Guanabacoa, urban farmers raise goats.

Photographs: Mario González Novo (1-7), Aurelia Castellanos Quintero (8)

known is Vivero Alamar, which was created on abandoned wasteland 8 km east of the city centre in 1997. Run by a cooperative with 180 members, Alamar's gardens produce some 300 tonnes of organic vegetables a year.

Agricultural production in Havana is implemented under two national programmes, one for urban and one for peri-urban areas (*see page 15*). It is strongly encouraged by the Cuban Government, which created the Havana Provincial Office of Agriculture, seven provincial technical departments and 15 municipal offices to assist the sector. The government has also introduced measures to grant vacant land free of charge for agriculture and to encourage the participation of women and youth.

Crop and animal production is recognized as a legitimate land use in the city's strategic plan, which allows agriculture in areas where construction is not foreseen, while its Land and Urban Management Scheme of 2013 sees peripheral areas as highly suitable for agriculture.

UPA is supported by a Technical Advisory Board, representing 11 agricultural research institutes, by a network of agricultural supply stores, municipal seed farms, composting units, veterinary clinics and centres for the reproduction of biological pest control agents, and by the city's College of Urban and Suburban Agriculture, which coordinates the training of producers and technicians, and helps to introduce new technologies, crop varieties and animal breeds.

Although *organopónicos* have become emblematic of agriculture in Havana, the city has developed other high-yielding production systems. It has 318 intensive gardens planted directly in the soil, and 38 ha of semi-protected gardens under awnings in soil enriched with vermicompost.

INIFAT

With drip irrigation, compost and good horticultural practices, Havana's gardens can produce 20 kg of vegetables per sq m in one year

The city's urban and peri-urban agriculture sector includes five agricultural enterprises, which manage some 700 crop farms, 170 cattle farms and 27 tree production units, two provincial companies specializing in pig and livestock production, 29 agricultural cooperatives, and 91 credit and service cooperatives that grow flowers and vegetables and raise small animals.

The total area under agriculture in Havana is estimated at some 35 900 ha, or half the area of Havana Province. Production in 2012 included 63 000 tonnes of vegetables, 20 000 tonnes of fruit, 10 000 tonnes of roots and tubers, 10.5 million litres of cow, buffalo and goat milk and 1 700 tonnes of meat.

In addition, 89 000 backyards and 5 100 plots of less than 800 sq m are used by families in the city to grow fruit, vegetables and condiments and to raise small animals, such as poultry and guinea pigs, for household consumption. In densely populated areas, food is produced in containers on rooftops and balconies. In all, some 90 000 Havana residents are engaged in some form of agriculture.

Product marketing is based on direct exchange between the producer and the consumer. Fresh produce is marketed through a wide range of outlets, including sales points located within 5 km of production units and throughout

Not only Havana, but **nationwide**

Urban and peri-urban agriculture in Havana has evolved along with Cuba's national programme for food production in urban areas. During the economic crisis of the 1990s, the focus was on developing *organoponic* and intensive gardens in empty or underutilized city spaces.

In 1997, what had been until then a popular participatory activity was institutionalized, with appropriate legislation, to become the *Movimiento de agricultura urbana*. In 2009, the government created a complementary programme for *agricultura suburbana,* which seeks to transfer the "extremely positive experiences" of urban agriculture to the peripheries of Cuba's towns and cities.

Both programmes aim at achieving local food self-sufficiency through "food production in the *barrio,* by the *barrio* and for the *barrio*". Their basic principles are agro-ecological production, local-level sustainability, continuous technological innovation, and producers' ownership of what they produce. They are expected to use simple technologies and minimal resources in order to increase food production and reduce dependence on food imports.

In Cuba as a whole, agriculture is now practised by some 40 000 urban workers on an area estimated at 33 500 ha. It includes 145 000 small farm plots, 385 000 backyard gardens, 6 400 intensive gardens and 4 000 high-yielding *organopónicos*.

A feature of UPA in Cuba is the high degree of local autonomy, which is seen as a key to ensuring food security. Cuba's strategy is to promote agriculture in small, local areas with a large number of producers who grow food for their own consumption and to meet the food needs of their neighbourhood. Each territory acts autonomously in producing inputs such as seed, animal feed, organic fertilizers and biological agents for pest control.

Overall coordination of UPA is carried out by the National Urban and Suburban Agriculture Group, under the direction of the Institute of Fundamental Research in Tropical Agriculture. The group brings together representatives of the Ministry of Agriculture and six other ministries, as well as those of 16 scientific institutions and 53 urban and suburban agriculture subprogrammes.

*Crop and animal production is recognized as a **legitimate land use** in the city's strategic plan*

Havana's urban neighbourhoods. In 2013, sales amounted to 58 000 tonnes. Almost half of that – 26 500 tonnes – was sold to the public through local sales points, while state markets and fairs handled 21 000 tonnes.

A further 6 770 tonnes were supplied through daily deliveries to almost 300 000 people in "priority destinations", such as schools, maternity homes, public health centres, hospitals and other institutions in the city. Many farmers, especially in the cooperative sector, market processed products, such as spices, and processed meats, fruit and vegetables, and have supply contracts with the tourist industry, which accounted for 3 500 tonnes of sales made in 2013.

The holistic approach to agriculture in Havana, and in Cuba generally, has been shaped by the need to produce high yields with minimal use of external inputs, especially agrochemicals derived from fossil fuel. It has been said that Cuba was the first country to experience a "peak oil" crisis, one that will eventually affect food production worldwide.

Concern over rising fuel and fertilizer prices, growing competition for land and water, and the environmental impact of agrochemicals led FAO to propose in 2011 a new paradigm of intensive crop production, one that is both highly productive and sustainable. FAO's "Save and Grow" model of agriculture uses an "ecosystem approach" that draws on nature's contributions to crop productivity.

That means, for example, using natural sources of plant nutrition, and controlling insect pests by protecting their natural enemies, rather than by spraying crops indiscriminately with pesticide. "Save and Grow" is the basis of a new FAO initiative aimed at fostering a global transition to sustainable crop, livestock, forestry and fisheries production.

INIFAT

Tomorrow's urban farmers? Schoolchildren visit an organoponic garden in Havana

Havana could serve as a good example for countries making the transition. Most of the agriculture in the city is fully organic – the use of agrochemicals in urban gardens is prohibited by law and is also impractical, given the limited quantities available. Because a reliable supply of soil nutrients is essential for improving garden substrate and maintaining high yields, the UPA programme produces compost, green manure, vermicompost, bio-fertilizer and liquid fertilizers, links gardeners to sources of manure, such as livestock production units, and identifies other local sources of organic matter, including crop and household wastes and agro-industrial residues, such as coffee husks and sawdust.

In order to control insect pests and diseases, producers are trained to analyse phytosanitary problems and to respond not by attacking the symptoms but by removing the cause – for example, improving drainage to treat mould. They use biopesticides and biological control agents supplied by the city's six centres for the production of natural pathogens, predators and parasites of insect pests.

The agro-ecological approach offers considerable cost benefits. The UPA programme has calculated that producing 1 million tonnes of vegetables under conventional agriculture requires around US$40 million worth of mineral fertilizer and US$2.8 million worth of pesticide. The amount of organic fertilizer required for the same level of production is around 1 million cubic m, and the main cost is the diesel fuel needed to transport it an average distance of 10 km to the farmer's field.

The fuel cost per tonne of organic vegetables is US$0.55, compared to a fertilizer cost of US$40 per tonne under conventional agriculture, representing a total saving of US$39.5 million. The cost of pest control is also reduced – from US$2.8 million to US$300 000 – by using biological control agents and biopesticides.

Other savings can be achieved through local production of good quality seed which, under intensive production, can improve yields by 30 percent. Given the high cost of imported seed, the UPA programme has established 10 local vegetable seed farms, which supply 40 percent of the lettuce seed and 20 percent of the Chinese chard sown in Havana's urban gardens. (Nationwide, municipal seed farms produce annually 17.6 tonnes of seed of 22 species and 40 varieties). Havana also has 28 units that supply high-quality plant seedlings – mainly of tomato, cabbage, lettuce, cucumber, peppers and onions – in root balls, ready for transplanting in the field.

Seed, soil improvers, vermicompost and biological pest control agents, along with tools and veterinary supplies, are sold through 52 agricultural stores, which are located in all 15 municipalities. The stores also provide technical services, advice and training to the city's farmers. All urban farmers have access to agricultural insurance, and to production loans from Havana's Banco Metropolitano.

*The **agroecological approach** has considerable cost benefits*

Havana has set guidelines for agricultural development in the rest of Cuba, and not only in towns and cities. Its approach has been adopted as a management model by the national Ministry of Agriculture, which promotes a mix of "technical-industrial" and agro-ecological production in rural areas.

Innovations such as organoponics, along with technologies for the production of bio-fertilizers and the processing and conservation of seed, have been transferred abroad through technical assistance to urban agriculture programmes in more than 10 Latin American countries, including Colombia, Mexico and Venezuela and other countries of the Caribbean. The Ministry of Agriculture's national Institute of Fundamental Research in Tropical Agriculture (INIFAT) has developed a three-year master's degree course in urban and peri-urban agriculture that has attracted students from Europe and Japan.

One key lesson from the past 20 years of experience in Havana is that, to be productive and sustainable, urban agriculture must adapt to physical urban conditions and to local potentials and resources. Adaptability will be required again as Cuba's economy improves and new priorities emerge in its city planning.

Since the dark days of the *período especial*, per capita GDP in Cuba has grown by almost 80 percent – one of the strongest performances in Latin America – thanks to economic reforms, growth in revenue from tourism and exports, and, most recently, a boom in the construction sector.

While Havana's new Land and Urban Management Scheme favours agriculture in peri-urban areas, it designates free spaces in the intermediate zone for industrial and service investments, and those in central areas for high-technology enterprises and major hotels. Many of the city's present farming areas will be affected by an urban reorganization plan, which calls for the removal of temporary plots in central Havana, a reduction in intensive livestock production in areas above the city's aquifer, and the removal of pig farms from urban areas.

MARIO GONZÁLEZ NOVO

Production of earthworms for use in making vermicompost, at a site near the Institute of Fundamental Research in Tropical Agriculture

However, agriculture has left an indelible mark on Havana's landscape and its proven benefits – food security, improved child nutrition, employment and the revival of social values and solidarity – are recognized by both the government and society at large. Among the Havana UPA programme's strategic priorities are to realize the full productive potential of urban agriculture and to accelerate the organization of urban food producers.

To achieve that, the programme plans to increase the output of biofertilizer and seed, strengthen support services, and build the capacities of producers in the management of infrastructure, the use of water-saving technologies and rainwater harvesting, and integrated pest management.

Meanwhile, Cuba is preparing the next generation of urban and peri-urban farmers. The country has some 3 000 study circles, where agricultural technicians and producers encourage children and youth to take up agriculture and learn more about agro-ecological production practices. In Havana, students are invited to take part in local agricultural activities, and schools use UPA as a practical example when teaching simple arithmetic, participatory production and social relations.

Agriculture has left an indelible mark on ***Havana's landscape***

MEXICO CITY

Home to more than 21 million people, the Mexico City metropolitan area sprawls across some 7 850 sq km, forming one of the world's largest urban agglomerations. At its heart is the Federal District – Mexico City proper – with an area of 1 480 sq km and a population of 9.4 million. The Federal District covers just 0.1 percent of the national territory, and more than half of it is, at least on paper, protected from urbanization. Known as the *suelo de conservación*, the protected area was created in 1992 to safeguard its vital ecosystem services, such as the city's supply of drinking water and oxygen, and includes forests, grasslands, wetlands and 300 sq km of farmland. But residential land is increasingly scarce in the urban zone, and almost 30 percent of the Federal District's population live in poverty owing mainly to the lack of health services and basic housing. As a result, the *suelo de conservación* is under constant pressure: at last count, more than 850 informal settlements had been built there and, by one estimate, its natural habitat is being lost at the rate of 600 ha a year. To prevent further degradation of the conservation zone, the Federal District's government is promoting sustainable, ecosystem-based agriculture in rural areas and food production in the city itself.

MEXICO CITY LIES AT 2 240 M above sea level in the southern part of the Valley of Mexico, and was built on a system of lakes that once covered 1 500 sq km. There, pre-Hispanic civilizations developed specialized food production systems, including floating *chinampa* gardens for horticulture and the *milpa* system of mixed maize, bean and squash cultivation on rainfed mountain terraces.

The exponential growth of the city – which reached the rate of 25 sq km a year between 1970 and 2000 – and of rural towns in the *suelo de conservación* has meant that, today, most agriculture in the Federal District can be regarded as peri-urban and even suburban.

The population of Mexico City economically active in agriculture is estimated at about 16 000, working on 11 500 family farms. Some 22 800 ha of land is dedicated to crop production, mainly in the southwestern boroughs of Tlalpan, Milpa Alta, Tláhuac and Xochimilco. Farming in those areas produces maize, fruit, vegetables and animals for family consumption and local sale, but includes large-scale production of nopal, amaranth, vegetables, herbs and ornamental plants destined for city and regional markets.

The 2012 harvest was valued at more than US$100 million and included 336 000 tonnes of nopal, 147 000 tonnes of forage oats, 12 500 tonnes of potatoes and 15 000 tonnes of broccoli, carrots, lettuce and a local herb, *romerito*. Although the Federal District is Mexico's leading producer of nopal and *romerito*, it is estimated that 80 percent of the food consumed in the city is supplied by other states of the country or imported.

Almost 90 percent of crop production is rainfed, and 80 percent of arable land is under annual crops, mainly forages and grain maize. Production of flowers, indigenous poinsettias and fodder oats generates more than half the total value of annual crops. Nopal is grown over 4 300 ha, or more than 90 percent of the perennial cropland, mainly in Milpa Alta. The animal population of the Federal District is estimated at some 6 650 head of cattle, 30 000 pigs, 10 000 sheep and 220 000 chickens.

Despite the constant pressure of urbanization, agriculture has survived in Mexico City thanks to farmer innovation and adaptation. For example, nopal has replaced maize as the main crop on the slopes of Milpa Alta, and flowers

UWE BEHM

IN BRIEF: MEXICO CITY

Most agriculture in the Federal District of Mexico can be regarded as peri-urban and even suburban, and it survives thanks to farmer innovation and adaptation. While still at an infant stage, urban food production is increasing.

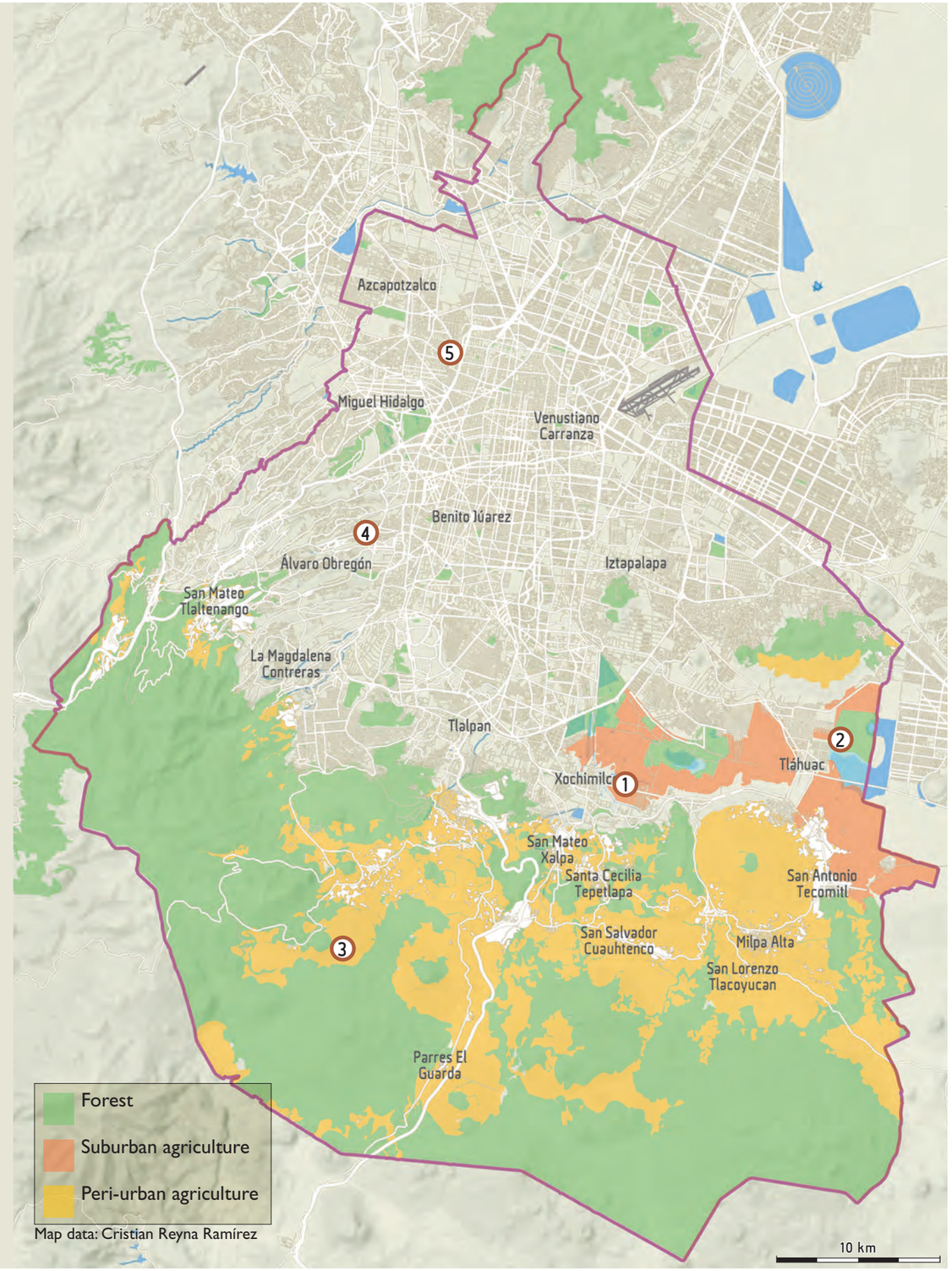
1 A greenhouse in Mexico City's southern borough of Xochimilco, which is famous for its flower production. In 2012, growers here shipped 2.1 million tonnes of potted poinsettias alone.

2 At left, farmers in Tláhuac borough harvest *romerito*, a local herb grown on the sites of ancient floating gardens, or *chinampas*. At right, a view from the city suburbs of Lake Chalco and Tláhuac farmland, which also produces alfalfa, beans and oats, and apples and pears.

3 A farmer weeds his maize field in Tlalpan borough, deep in the *suelo de conservación*.

4 Residents of the Emiliano Zapata housing estate, in Álvaro Obregón, at a workshop on greenhouse gardening.

5 Vegetables grow in containers on the roof of the Federal District's Youth Institute, in Miguel Hidalgo.



Map data: Cristian Reyna Ramírez

Photographs: SAGARPA (1), Luis Manuel Rodríguez Sánchez (2), SEDEREC (3,4), Fernando Rodríguez Rodríguez (5)

are now grown in greenhouses built on old *chinampas*.

Peri-urban agriculture is practised in boroughs at middle and higher elevations of Xochimilco, Tlalpan, Milpa Alta, Magdalena Contreras, Alvaro Obregon and Cuajimalpa de Morelos, which have the lowest population densities. Plots range in size from 1 to 3 ha and are used for the production of maize, amaranth, nopal, oats, legumes, fruit and vegetables. Farms there also raise livestock such as sheep, calves, rabbits, pigs, horses and poultry.

Closer to the city centre, in Xochimilco and Tláhuac, agriculture continues in lowland areas that were, until recently, peri-urban but are now "locked" into medium density suburbs. Holdings are usually of 1 ha or less on *chinampas* and filled-in canals. The dominant production system is horticulture and floriculture, with some maize, using treated water for irrigation. In most suburban villages, sheep, rabbits, birds and horses are still raised in backyards, and some small dairy farms and indoor pig production units are still found.

Since 2000, Mexico City's government has increased its support to agriculture in the Federal District, with the main objective of protecting the ecosystem services that suburban and peri-urban areas provide to the city, and to a lesser extent, to ensure a local food supply. An important step forward was the creation in 2007 of the Secretariat for Rural Development and Equity for Communities (Sederec), which spearheads the city's efforts to promote food production that is free of agrochemicals and, in some cases, completely organic.

Peri-urban and suburban agriculture is supported by a variety of legal instruments. The Federal District's General Programme of Ecological Management delimits the area of the *suelo de conservación*, and its Environmental Law promotes organic farming systems and prohibits the use of agrochemicals and synthetic fertilizers in the conservation zone. To guide its policies and programmes for sustainable agriculture, the Federal District is establishing a Rural Council, representing producer organizations, traders and service providers.

Sederec's programme for agriculture and rural development aims at improving production planning, training, technology development, agroprocessing and marketing. Through that, and other, programmes for rural areas, the city and Mexico's Federal Government invested between 2007 and 2012 some US$24.6 million in horticulture, floriculture and crop and livestock production, US$37 million in the conservation and sustainable use of natural resources in primary production, and US$1.8 million in emergency assistance to farmers affected by extreme weather events, such as drought and flooding.

SEDEREC

Each year, Mexico City farmers harvest more than 300 000 tonnes of nopal (below). Improved technologies for making products such as jam – on sale, above, at a city fair – would help boost small farmer incomes

SEDEREC

Another Sederec programme, for the promotion of traditional food culture, helps rural farmers to enter local, national and international markets, and organizes trade fairs and exhibitions in the Federal District. Meanwhile, the city's Secretariat for the Environment has instituted Mexico's first system of organic certification of produce, known as the Green Seal, and has set standards for organic agriculture in the conservation zone.

All seven of the city's boroughs with rural areas promote the local production of maize, vegetables, fruit, nopal, fodder, medicinal and ornamental plants, as well as small-scale farming. For example, the Programme for Sustainable Rural Development in Milpa Alta provides subsidies to farmers who preserve local maize varieties under traditional production systems with low environmental impact.

Achieving sustainable agriculture in Mexico City's peri-urban and suburban areas will require action on several fronts. In the boroughs of Tláhuac and Xochimilco, the only suburban agricultural areas with permanent water for irrigation, the overexploitation of aquifers by domestic and industrial users has led to a serious decline in water supply and quality, and to ground subsidence.

The challenge over the coming decade will be to increase the capacity for rainwater harvesting and for storage and treatment of wastewater for

use in irrigation, and to rehabilitate canals and *chinampas* in the remaining lake area. That will require a new vision among government agencies responsible for the city's water management. At present, there is little coordination among the agencies, which cannot, therefore, respond in an integrated way to the growing demands on the Federal District's water resources.

New approaches are also needed in technical assistance to farmers. Currently, government support is delivered through projects using professional service providers. A more effective strategy would be to involve the government, research institutions and experienced farmers in developing applied research that reflects the real needs of farmers; deliver advisory services through programmes rather than individual projects; and promote farmer-to-farmer extension.

Reducing the environmental impact of agriculture in the *suelo de conservación* also requires changes in current regulations. The law prohibiting the use of agrochemicals lacks mechanisms for enforcement – for example, instead of banning or strictly regulating the marketing of mineral fertilizer and synthetic pesticide, and promoting eco-friendly alternatives, it places responsibility for compliance on farmers, not on the companies that manufacture and supply the inputs.

Tougher measures are needed, especially, in the production of ornamental plants, where the intensive use of agrochemicals is widespread and farmers are exposed to a high risk of pesticide poisoning. Assessments should also be carried out to measure the real environmental impact of recommended practices, such as the application of high volumes of fresh manure in the production of nopal, which has been linked to greenhouse gas emissions and the leaching of nitrates into groundwater.

SEDEREC

In Tláhuac, farm workers harvest verdolaga, a succulent that is eaten as a cooked vegetable or in salads

A successful transition to sustainable agriculture will also depend on the efficient management of urban organic wastes to produce high volumes of compost for use in suburban and peri-urban areas. Some of Mexico City's boroughs have programmes for composting garden wastes, and a composting plant has opened in the Eastern metropolitan area. However, much work is needed to improve the quality of the compost and its distribution to farmers. Measures are also needed to encourage the production by farmers' cooperatives and microenterprises of biological agents for the control of pests and diseases.

The supply of seed for horticulture and floriculture is a thorny issue. State seed production was abandoned in the 1980s, and seed supply is now dominated by large foreign corporations and a few Mexican companies. The cost of certified seed, especially of some vegetables such as broccoli, is very high and producers are increasingly dependent on a limited range of commercial varieties. Action to encourage the local production of seed – involving government, research institutions and farmers' cooperatives – would not only help reduce production costs. It would also help protect Mexico's agrobiodiversity and ensure national food security.

Improving small farmers' incomes requires the introduction of improved technologies for processing, particularly of nopal and maize. Although processed nopal and nopal-based cosmetics have considerable potential, the volume of production is still low. In the case of maize, the main challenge is adding value to surplus grain maize, which is traditionally sold cheaply in local and regional markets. Transforming maize farmers from producers of raw materials into producers of processed foods calls for very specific technological innovations – such as toasters, mills and *tortilla* makers – that are affordable and adapted to the characteristics of maize landraces, as well as better marketing opportunities.

Small farmers have only limited access to Mexico City's huge wholesale market, the *Central de Abasto*, and marketing alternatives need to be developed. For small-scale farmers with diversified production, they include direct producer-to-consumer trading at weekend markets. Consumer organizations that are motivated by economic solidarity can also help develop outlets for organic produce, which is usually sold in middle and upper class areas at higher prices than those found in supply centres and low-income areas. The city government should strengthen a Sederec initiative that purchases food for distribution to soup kitchens, prisons and hospitals.

Finally, younger farmers need secure access to arable land in suburban and peri-urban areas. As the value of land is determined by its suitability for urbanization, rather than for agriculture, land prices have soared. Efforts to promote organic production will have little success if prospective farmers lack secure title to land and,

The law prohibiting the use of ***agrochemicals*** *lacks mechanisms for enforcement*

A space for **organic vegetables** in the city centre

Huerto Romita is a 56 sq m gardening centre, located in the heart of Mexico City, which provides an area for community vegetable production and teaches permaculture techniques. It also helps in starting up school gardens, and installs home and community gardens for city residents.

HUERTO ROMITA

HUERTO ROMITA

At left, plants growing in containers at Huerto Romita. Above, a meal with music to celebrate the garden's sixth anniversary

receive consequently, little incentive to invest in soil fertility or other improvements in the agro-ecosystem. The government could do more to encourage sustainable agriculture by creating mechanisms for land redistribution, such as providing low-interest credit for young farmers or buying land and leasing it to new farmers.

Fully urban agriculture is still at an infant stage in Mexico City. There is no widespread tradition of producing food in built-up areas, and the high density of buildings limits the availability of space for agriculture. In addition, the city's well developed system of subsidized food marketing, along with the rise of convenience grocery stores and the increasing availability of imported food, guarantee ready access to food for the vast majority of the population. Buying food, rather than producing it, remains the most attractive proposition for most inhabitants.

However, urban agriculture has been placed firmly on the policy agenda of the Federal District government through the efforts of Sederec, and through initiatives of NGOs, neighbourhood assemblies and youth groups.

Sederec's Programme for Small-scale Sustainable Agriculture in the city is promoting organic production in home and community gardens as a source of food for low-income households as well as cash from the sale of surpluses through local markets. Between 2007 and 2012, the Secretariat invested some US$6 million in 2 800 urban agriculture projects – including gardens in homes, housing units and social rehabilitation centres – directly benefiting 15 700 city residents.

In 2013, Sederec signed an agreement with Havana's Institute of Fundamental Research in Tropical Agriculture to help develop urban agriculture in the Federal District, and launched a programme with the boroughs of Alvaro Obregon, Cuauhtémoc, Miguel Hidalgo and Cuajimalpa to introduce greenhouse horticulture on social housing estates. The city has received requests from at least 400 housing estates for assistance in creating their own urban gardens.

Meanwhile, civil society has made a significant contribution to popularizing agriculture in the city. One notable initiative is the Romita Urban Demonstration Garden *(see page 28)*, which conducts gardening workshops for the general public in the capital and other Mexican cities, and develops urban agriculture projects with private companies.

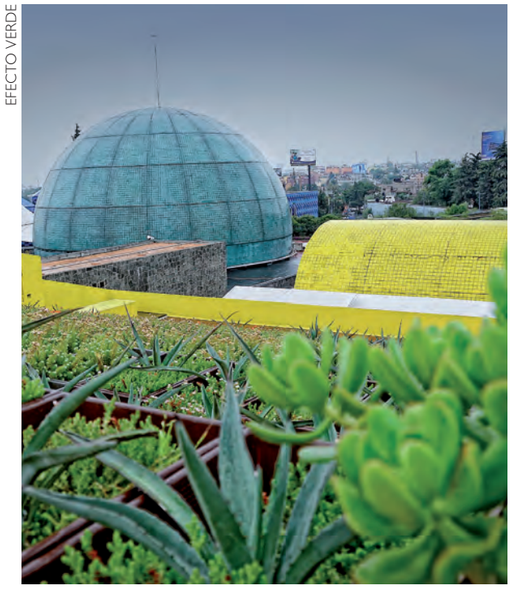
In urban areas of the borough of Iztapalapa, residents' organizations have started small-scale horticulture projects, while the Miravalle community assembly in Sierra de Santa Catarina has established gardens for the production of vegetables, nopal and medicinal plants using recycled containers, rainwater harvesting and organic composting. Another emerging trend is the establishment of fresh produce markets – such as the centrally located El Cien and Tianguis Alternativo – which provide outlets for organic producers.

Green roofs on schools, museums and corporate buildings

Government and private initiatives are "greening" rooftops across Mexico City's urban area. The Federal District's Secretariat for Urban Development and Housing has promoted rooftop hydroponic gardens, while the Secretariat for the Environment has a programme for greening roofs with succulent plants to help reduce the impact of air pollutants. So far, the programme has installed beds of succulents on more than 12 300 sq m of rooftops over schools, hospitals, the city's Natural History Museum, and other civic buildings. Some of Mexico City's largest corporate buildings also host green rooftops.

A group of urban planners, Efecto Verde, has proposed covering with low-maintenance vegetation 40 percent of the city's urban surface by 2030. Efecto Verde recently installed a 265 sq m green roof on the Papalote Children's Museum (*below*), made up of 1 593 pots with a variety of plant species.

EFECTO VERDE



***Civil society** has made a significant contribution to popularizing agriculture in the city*

ANTIGUA AND BARBUDA

With a population of 90 000 and total annual GDP of some US$1.2 billion, the twin-island state of Antigua and Barbuda ranks among the world's "high income non-OECD" countries. But it also has one of the highest rates of income inequality in the Caribbean. A study in 2007 found that 28 percent of the country's population was indigent, poor or at risk of falling into poverty in the event of an economic shock or natural disaster. Both happened in 2008. Global food price inflation led to steep increases in the local cost of food, which accounts for almost half of spending among the poorest households. In October that year, Hurricane Omar brought floods that swept away farmland and livestock, and caused heavy crop losses. Both events prompted the government to accelerate its plans for boosting the country's food production, including action to promote traditional home gardening. Six years later, the National Backyard Gardening Programme produces 280 tonnes of vegetables annually and is seen as key to achieving "zero hunger" in Antigua and Barbuda.

GILLES MESSIAN

ANTIGUA AND BARBUDA has a long tradition of backyard (or "kitchen") gardens, used to grow food for the family and a little extra for sharing with friends and neighbours. But that tradition was in steady decline, as people shifted away from fruit and vegetables to processed foods and diets rich in fat, sugar and salt. At the same time, farming areas have been depopulated as rural residents drifted to the capital city, Saint John's. Almost 60 percent of the population now resides in the districts of Saint John's City and Saint John's Rural, and of that "rural" population is likely to be engaged in urban pursuits.

Along with urbanization and the closing of the sugar industry, agriculture's contribution to the national GDP has slipped to just 2 percent, dwarfed by the tourism and banking sectors. Less than 3 percent of the labour force works in agriculture. Farming suffers from intense competition for land from housing and tourism development, a lack of year-round production and processing technologies, and adverse environmental conditions, including chronic water shortages and widespread deforestation.

Although horticulture is now the dominant agricultural activity, in 2008 it was meeting barely more than a quarter of local demand. The country's bill for imported fruit and vegetables rose from US$4 million in 2000 to US$12.8 million in 2008, when the volume of imported vegetables reached more than 5 200 tonnes. That year, local vegetable production was just 2 000 tonnes.

The impact of food price inflation and Hurricane Omar in 2008 underscored the vulnerability of Antigua and Barbuda's food system to external shocks. To strengthen the country's food producing capacity, the Ministry of Agriculture, Lands, Housing and the Environment launched in 2009, with assistance from FAO, a National Food Production Plan. As well as providing for the rehabilitation and upgrading of agricultural infrastructure – such as agricultural stations, laboratories, farm roads, dams and wells – the plan called for action to boost the contribution of traditional home gardens to national food security.

That initiative has grown into the National Backyard Gardening Programme, which is managed by the Ministry's Agricultural Extension Division. The programme is now active in all districts of the country, including rural areas, with 2 500 registered households participating. Including members of those households, the programme currently benefits directly an estimated 7 500 people.

Backyard farmers are encouraged to register with the Ministry of Agriculture so they can access support services on request. Support includes the advice of eight technical officers and six community facilitators, as well as the supply of vegetable seeds, seedlings, fruit trees and inputs, free of charge or at minimal cost. In 2011, the programme distributed fertilizer and 250 000 assorted vegetable seedlings to backyard farmers. It has also introduced modern, productivity-enhancing technologies, such as drip irrigation, vermicomposting, shade houses, and microgardening in cut drums and on table pallets.

The number of backyard gardeners has grown along with the effects of the global economic recession, which has reduced local employment opportunities and incomes. The participant base now includes religious organizations, community groups, schools, para-military services and prisons. There is no class distinction among

IN BRIEF: ANTIGUA AND BARBUDA

Thanks to the National Backyard Gardening Programme, almost 10 percent of Antigua and Barbuda's population eat home-grown food. The target is to harvest 1 800 tonnes of vegetables a year in citizens' backyards.

1 In the capital, Saint John's, from top-left, clockwise: Students of the Princess Margaret School show off poultry and eggs, produced in their chicken shed; one of the city's vegetable growers with celery that she sells at the public market; officials help children start their own vegetable garden at the Mary E. Piggot Primary School; backyard horticulture along Fort Road, northern Saint John's.

2 At the Hawksbill Bay hotel, the project held a display of locally grown pumpkin, cabbage, cassava and yam.

3 An extensionist visits a backyard gardener who grows thyme, a favourite in Caribbean cuisine, on tables in the southern town of Falmouth.

Photographs: Owolabi Elabanjo (1,2), Julius Ross (3)

participants, who include lawyers, doctors, pilots, accountants, nurses, civil servants and businessmen. But there is a clear gender dimension: home gardening is dominated by women, who outnumber male gardeners by more than 3 to 1. As regards family size, 55 percent of registrants have from one to three family members, and 43 percent from four to six. Only 2 percent of the registrations came from families of more than six persons.

The gardens are used to grow traditional local vegetables, such as eggplant, cucumbers, okra, thyme and chives, as well as tropical crops that are also imported, such as tomatoes, carrots, sweet peppers, onions and cabbage. Most vegetables are consumed fresh, with little or no processing, although hot peppers are often sundried or refrigerated, okra and spinach are blanched, and fruit is processed into drinks.

The amount of land being used for backyard gardening cannot be easily quantified. Most gardens are very small, ranging from 1 to 10 sq m, and many producers grow vegetables in recycled containers of various shapes and sizes. However, using an average productivity coefficient, the Extension Division calculates that urban and peri-urban gardening occupies a land area equivalent to about 20 ha.

Of the 2 500 households engaged in backyard gardening, more than two-thirds consume most of what they grow, and give some away to friends, colleagues and neighbours. The main benefits are savings on food purchases, and improved household nutritional status. Around 650 also use their gardens as a source of income, by selling produce at local markets and shops. Home production has also created jobs in the processing of produce into sauces, jams and jellies, the production of seedlings, and grafting trees. As well as promoting vegetable gardening, the Extension Division encourages poultry keeping in schools and apiculture in backyards.

The National Food Production Plan and the Backyard Gardening Programme have considerably improved Antigua and Barbuda's food security. Vegetable production in rural areas reached 3 200 tonnes in 2012, an increase of more than 60 percent since 2008. Over that period, urban and peri-urban production grew even more rapidly, from 500 to 900 tonnes.

Backyard gardens accounted for about 280 tonnes, or 7 percent of the country's vegetable production. Another 620 tonnes came from peri-urban vegetable growers who have expanded their acreages and, thanks to the use of improved seed, integrated pest management and packaging, are supplying lettuce, spinach and other high-value crops to hotels and supermarkets, and making high-volume sales in public markets.

Home vegetable production is also seen as a food security bulwark in case of extreme weather events. When Hurricane Earl struck Antigua in August 2010, flooding "drowned" large fields of vegetables in rural areas and caused crop losses of around 20 percent. However, backyard production was not significantly affected, since home gardens are smaller in size, more intensively managed and quick to regenerate.

Backyard gardening is now so popular that the government has designated 21 April the official National Backyard Garden Day. Government support to urban and peri-urban agriculture is included in the National Food and Nutrition Security Policy, the National Poverty Reduction Strategy, the National Economic and Social

*Backyard gardens accounted for about 280 tonnes, or **7 percent** of the country's vegetable production*

Zero hunger by 2015

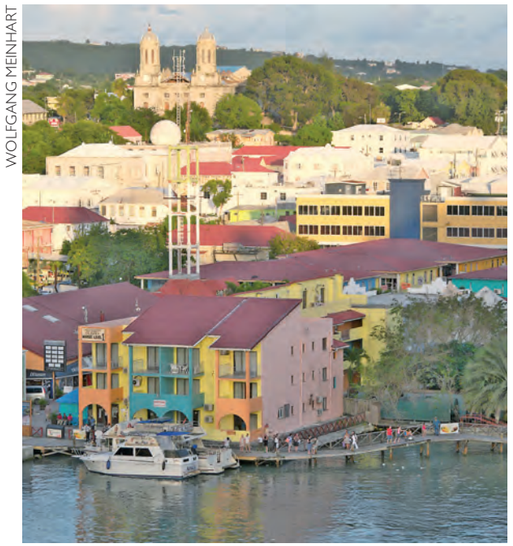
Antigua and Barbuda's backyard gardens play a key role in an ambitious plan to achieve "zero hunger" in the country by 2015. Launched in February 2013, the plan takes up UN Secretary-General Ban Ki-moon's Zero Hunger Challenge, which calls for action to ensure, worldwide, 100 percent access to adequate food all year round, zero stunting among children of less than two years, 100 percent growth in small farmer productivity and income, the sustainability of all food systems, and zero loss or waste of food.

The plan, which was prepared jointly by the Government of Antigua and Barbuda, FAO and four other UN and intergovernmental organizations, aims at eliminating hunger and extreme poverty in the island state within two years. Its strategy is to strengthen and diversify the agriculture sector, improve the nutrition and health status of the population, expand social protection, create employment and income generating opportunities for the poor, and ensure good governance of hunger and poverty programmes.

Backyard gardening is seen as a "critical element" in increasing food availability at the household level. The plan is expanding the scale of the programme, with special focus on women and youth. Community facilitators are working with extension officers in six backyard gardening demonstration centres, where vulnerable households are trained in establishing backyard plots and the use of technologies such as drip irrigation and microgardening. The plan also calls for starting vegetable gardens in Antigua and Barbuda's 33 schools, and including produce from backyard and school gardens in the national school meals programme, which provides meals daily for 3 000 students.

BRIAN DIGITAL

WOLFGANG MEINHART



Farming areas have been depopulated as rural residents drift to the capital, Saint John's (top). While Antigua and Barbuda is known as a yachtsman's paradise, in 2007 some 28 percent of its population was indigent, poor or at risk of falling into poverty

DESMOND BROWN/IPS

A couple admire their home garden in Saint John's

Transformation Plan and, most recently, the Zero Hunger Challenge Plan of Action *(see page 34)*. The national Medical Benefit Scheme, with the assistance of the Ministry of Agriculture, has launched "Grow what you eat", a school gardening programme that is now active in four primary schools.

The government has set a target of producing at least 1 800 tonnes of vegetables annually in citizens' backyards. In order to do so, the programme will need to be considerably expanded and to draw on the lessons learned so far.

Continued government support is crucial. Backyard agriculture needs to be factored into the national budget so that it is included in allocations made for the provision of services to agriculture as a whole. Funds are needed to increase the supply of material inputs, such as seed and irrigation systems, and to introduce improved production and post-harvest technologies. The country's Bendal agricultural station needs upgrading in order to increase the mass production of seedlings for distribution. A supply of small tractors would also help larger-scale, peri-urban horticulture.

One of the major challenges to the programme's sustainability is access to resources, especially for vulnerable families. While there are credit institutions that lend to farmers, borrowers need collateral, which low-income families have very little of.

There is also a need for community education in the use of greywater on vegetables, which is not a common practice. Since water is a scarce and expensive resource in Antigua and Barbuda, it is important to reduce growers' dependency on the domestic supply through small-scale greywater recycling.

Because most of the crops grown in backyards are consumed fresh, training is also needed in food safety and in integrated pest management, to eliminate the use of synthetic pesticide. In addition, there are problems in post-harvest management and storage, which lead to high food losses.

Finally, creating networks of gardeners would help them to share experiences, technology and information, and to organize group visits to see what others are doing and how to make home-level innovations more sustainable. Among priorities for future development, therefore, is the formation of a backyard producers' association, which would assist them in sourcing inputs and marketing output cooperatively.

Training is needed in ***integrated pest management*** *to eliminate the use of synthetic pesticide*

TEGUCIGALPA

Honduras is among the world's poorest countries and has one of the highest rates of urban poverty in the Latin America and Caribbean region. In 2010, almost 60 percent of the country's 4 million city dwellers had incomes below the national poverty line. The capital, Tegucigalpa, is emblematic of the country's urban development challenges. Since 1970, the population has increased fivefold, from 220 000 to an estimated 1.2 million, and is expected to exceed 1.7 million within 10 years. Almost half of the urban area consists of informal settlements. Most of Tegucigalpa's *barrios marginales* are found on very steep slopes, prone to landslides, and lack even the most basic services. They also suffer the highest crime rates. Four of those settlements were chosen in 2009 for a pioneering project to establish household gardens. The project's impact has been far-reaching – in improving food and nutrition security, strengthening communities, and helping to shape public policy on urban development.

REUTERS/TOMAS BRAVO

The Pilot Project for Strengthening Urban and Peri-urban Agriculture and Food Security in the Central District – which comprises Tegucigalpa and its neighbouring sister city of Comayagüela – was the first of its kind in Honduras. Led by FAO and the district mayor's office, its aim was to contribute to the food security of people living in extreme poverty in urban and peri-urban areas. The project's immediate target was to increase the daily consumption of fruit and vegetables, which was estimated at 110 g per capita, by installing and maintaining community and family gardens.

The US$480 000 project was implemented in three neighbourhoods in the eastern part of the city, Villanueva, Los Pinos and Nueva Suyapa (work in a fourth neighbourhood, Monte de los Olivos, had to be abandoned owing to the threat of gang violence).

The three neighbourhoods have many similarities. Both Nueva Suyapa and the nearby settlement of Villanueva were established to house people displaced by hurricanes and other natural disasters, and have grown, with rural-urban migration, into communities with a total population of 42 000. Los Pinos began with a land invasion in the 1980s and its population has grown to 10 000 with the arrival of settlers from the countryside and people who lost their homes in landslides in other parts of Tegucigalpa.

More than half of the area's adults have no formal jobs and, among the poorest households, average income from informal employment amounts to US$6 a day. Around US$3.60 is spent on food. The *barrios* lack basic services, such as piped drinking water, sewerage and schools. Water is available from the municipal network only once a month for three hours, which means that

LAIF/CONTRASTO

Built on steep hillsides, Tegucigalpa's informal settlements are prone to landslides, and lack basic services, such as piped drinking water, sewage and schools

families must collect and store their water supply in containers, barrels and tanks. Soils are of poor quality and many families do not have sufficient space to grow food near their homes. Another common problem is pervasive insecurity – gangs regularly conduct "war tax" collections, extorting money from residents and business owners.

But, amid the daily hardships of life in Nueva Suyapa, Villanueva and Los Pinos, there was one beacon of hope: the high level of solidarity and community participation among women, which was to be one of the key factors in the success of the gardening project.

A baseline study had found that 72 percent of households in the three neighbourhoods were headed by women. Many women had had their first child at the age of 15, and were the sole providers for households which, on average, numbered five people, including children and

IN BRIEF: TEGUCIGALPA

A project introduced high-yielding – but low-cost – gardening in some of Tegucigalpa's poorest *barrios*. Result: bumper harvests of radish, coriander and lettuce, and big savings on family food bills.

1 Harvesting lettuce from a backyard garden in Monte de los Olivos. Families participating in the project grew more than half of the fresh vegetables they consumed.

2 In Villanueva, many women use old tyres filled with gravel to purify kitchen greywater, and re-use it on their gardens.

3 A table garden made from discarded building materials in Los Pinos. The tables are filled with good quality soil.

4 At left, project participants learn good horticultural practices at the Nueva Suyapa demonstration training centre. Because soil quality is more easily enhanced in small spaces, they used various containers to optimize production. At right, for example, women make hanging tubes – dubbed "sausages" and "canoes" – from plastic sheeting.

Photographs: Karla Andino López

the elderly. Among the minority of married women, many reported that their husbands "did not work" or were absent, having emigrated or having found seasonal jobs outside the city. A large number, especially in Nueva Suyapa, had separated from husbands or partners.

For many of the women, a typical day started at 4 a.m., when they began preparing *tortillas* to sell from door to door during the day, for US$0.25 each. Some women had temporary "government jobs" sweeping the streets or cutting grass, for which they earned around US$110 a month. After cleaning the house and supervising children's homework, their typical day ended at 9 p.m., after preparing and serving dinner.

Nevertheless, a high proportion of the women found time for voluntary and community work, usually with churches and civic organizations. Their primary motivation: *que la gente tiene mucha necesidad* ("that people have many needs"). In Nueva Suyapa, for example, women host foreign volunteers, who visit each year to assist in community projects and teach orphaned children. In Villanueva, some women support children with after-school coaching.

It was women such as those – poor, under-employed, but interested in the initiative – who made up the vast majority of the 1 220 people who volunteered to join the gardening project. More than half were women aged 20 to 39 years; more than 40 percent were aged from 40 to 60. When the project began, 70 percent of the participants did not grow anything around their homes, but said they were willing to learn.

Learning took place in demonstration training centres (DTCs) which the project established in each of the three neighbourhoods. There, participants were trained in the use of a variety of home gardening practices and technologies – bed preparation, vermicomposting, seedling production, micro-gardening in containers, hydroponics and integrated pest control – for the production of fruit, vegetables and other crops.

Training was held once a week, with courses divided into eight modules conducted over a period of two months. Trainers used a "learning by doing" approach, plus a manual on home gardening prepared by an FAO project among vulnerable communities in Colombia. They stressed the importance of diversifying production and of consuming garden produce in the home.

Since participants in the training sessions had different levels of competence in agriculture, the DTCs served as showcases that allowed them to choose technologies most suited to their capacities and needs. The practical knowledge of rural people who had settled in the area made a great contribution to the training process.

In the project's second phase, the participants applied what they had learned by establishing their own home gardens, with technical experts following progress and providing guidance. The objective was to establish gardens with at least five vegetables, of different colours, that would satisfy the minimum nutritional requirements of the households.

In the third and final phase, each trained participant received inputs of seed and a barrel or tank for storing water. Those inputs were not provided free of charge: the home gardeners were required to deposit 50 percent of their value in a fund – known as a *caja urbana*, or "urban box" – designed to serve as a source of credit for the future purchase of inputs. Each participant

The practical knowledge of ***rural people*** *who had settled in the area made a great contribution to the training process*

From **school garden** to microenterprise

In the *barrio* of Cerro Grande, in Tegucigalpa's sister city of Comayagüela, a local primary school heard about the gardening project and requested assistance in starting up their own school garden. The project trained teachers to train students, and installed a water storage tank, an irrigation system and a greenhouse for producing seedlings.

The students now not only grow fruit, vegetables and herbs in their garden, but process and sell their produce as pickles, jams, sweets and fortified tortillas to relatives and in the local community. There has also been a positive "multiplier effect" – some 40 families of Cerro Grande No. 2 school students have started up their own backyard gardens.

VANESSA BALDASSARRE

Students at Cerro Grande No. 2 school have fun while pumping water to their garden's irrigation system

paid around US$60 for a water tank and US$16 for a barrel.

The project approach was to promote low-cost gardening technologies that were suited to the local soil and climate, were easy to implement, and used local inputs. In Tegucigalpa, the project tested various solutions to two major constraints to production: the lack of water and the poor quality of soil.

Several technologies were proposed to overcome water shortages: drip irrigation using disposable containers, applying mulch to conserve soil moisture, and using greywater that had been filtered with a system made from recycled tyres filled with charcoal and gravel. The filters remove from the greywater soap and fats derived from washing dishes, cleaning clothes and taking baths, making it safe to use on the gardens. The system was widely adopted in Villanueva and Los Pinos thanks to its low cost (around US$25), and the good quality of the water after filtering. The project also assisted in the construction of 300-litre wells made from tyres and used to store filtered greywater or rainwater.

Because soil quality is more easily enhanced in small spaces, various containers were used to optimize production. They included hanging tubes, dubbed "sausages" and "canoes", made from plastic sheeting, and baskets, plastic bottles and fruit juice cartons. For 80 percent of participants, the preferred containers for growing crops were old tyres, which they found more productive and easier to irrigate. The project encouraged the cultivation of fruit as well as vegetables. It provided 285 avocado, guava, lemon and mango trees, which participants planted around their homes.

By the end of the project in December 2011, more than 1 200 people had been trained in gardening, food security and nutrition. They had also participated in workshops on food preparation, where they learned new ways of preparing and consuming vegetables. (One of the project outputs was an "urban garden cookbook" developed by the gardeners from an exchange of recipes during the workshops.)

Follow-up studies found that almost 90 percent of the people trained had established gardens and were growing at least six basic crops – radish, coriander, lettuce, beetroot, carrot and cucumber. Many had started planting other vegetables, such as tomatoes, spinach, hibiscus, squash, bell peppers and basil. Another popular crop was cassava, which is well adapted to local soil and climatic conditions and requires low maintenance. Some family gardens were found to contain up to 30 different species of fruit trees, vegetables and medicinal plants.

More than half of vegetables consumed by the families participating in the project came from their own gardens. Furthermore, the average family had increased its daily per capita consumption of fruit and vegetables from 110 g at the beginning of the project to 260 g.

After monitoring the prices of vegetables in local shops and markets, the project estimated that the value of the gardens' contribution to the typical family diet ranged from US$20 to US$36 a month. Some home gardens produced a surplus that women shared with relatives and neighbours or sold through shops. Home production had also reduced many married women's dependence on their husbands for the money needed to buy food.

Including household members, the increase in fruit and vegetable consumption and income had

KARLA ANDINO LOPEZ

KARLA ANDINO LOPEZ

The active participation of women was one of the key factors in the success of the FAO gardening project in Tegucigalpa

*Family gardens contained up to **30 different species** of fruit trees, vegetables and medicinal plants*

benefited more than 6 000 people, more than 10 percent of the total population of the three neighbourhoods, at a cost to the project of US$80 per head.

From the outset, the gardening project sought to promote strong community participation. It identified key leaders and actors in each community and involved them in project activities. Many later became facilitators, encouraging others to take up gardening. Project staff also organized visits by participants to gardens in other neighbourhoods so they could share ideas and technologies.

Throughout the process, the women of Nueva Suyapa, Villanueva and Los Pinos formed new friendships that have strengthened their communities and led them to join together in other social and economic activities. In Villanueva, for example, six gardeners formed a group, "Among women", which has obtained a US$100 loan for their small clothes-making business.

But the most important community development innovation to emerge from the project are the *cajas urbanas*, the self-managed credit and savings funds. The idea was an adaptation of rural banks, which had been established in rural areas of Honduras by an FAO food security project. Farmers were required to deposit part of the proceeds from the sales of produce to form the initial capital of the bank.

In the Tegucigalpa gardens project, participants were asked instead to pay at least 50 percent of the value of inputs into the fund. Urban boxes were created in all three neighbourhoods under the guidance of project staff, who advised on the formation of their boards of directors and the drafting of their regulations. In all, nine banks with a total membership of 200 were formed, with the aim of offering financial services to members and neighbours.

Two years after the end of the project, four are still operating: "Blessing of God" and "Women struggling for a new dawn" in Nueva Suyapa, "Planting hope" in Villanueva and "United development partners" in Los Pinos. As the names suggest, all attribute their success and sustainability to "good organization and communication" and the trust that exists among their members.

To build up capital, the gardeners deposited income from the sale of vegetables, seedlings and snacks, and organized fund-raising activities such as raffles. The banks provide loans to members and neighbours, ranging from US$15 to US$100, that are used to buy equipment and inputs for home gardens or raw materials for microenterprises (for example, ingredients for making *tortillas*, *tamales* and *enchiladas*). The banks are also a source of cash that can be used to buy medicines when family members fall sick. Interest rates are 3 percent for members and 5 percent for neighbours, far lower than rates of commercial banks, NGOs and moneylenders, which start at 12 percent.

Gardening women have won economic independence and the respect of their neighbours and children

KARLA ANDINO LOPEZ

All *cajas* require members to deposit monthly savings – usually of at least US$1 – and some exclude members who fail to save. Interest on savings accounts is 12 percent a year, which has helped many women build up readily available cash reserves. At the end of each year, members collect half of the interest and return half to the bank as capital for further investment.

In 2013, the four banks held a total capital of more than US$4 000. A recent evaluation found that, through the banks, the gardening women have been able to discover their own capabilities, assert economic independence from husbands and partners, and win the respect of their neighbours and children.

The impact of Tegucigalpa's urban gardening project has been felt beyond Nueva Suyapa, Villanueva and Los Pinos. It also influenced the decision of the Government of Honduras, in 2011, to extend its National Programme for Sustainable Rural Development to urban areas, for the benefit of vulnerable urban populations. The programme, which is led by the Ministry of Agriculture and Livestock, is now a key part of the country's National Vision 2010-2038, which calls for the eradication of hunger and extreme poverty, massive job creation and the sustainable use of natural resources.

Among the Ministry's priorities: to promote food security through participatory projects with urban communities, and to improve their access to financial resources by expanding the rural banks programme to urban areas.

MANAGUA

Among Central American countries, Nicaragua has made the firmest commitment to urban and peri-urban agriculture. The expansion of UPA is a key strategy in its national development plan for 2012-2016,

and a recently launched government programme aims at establishing 250 000 home gardens in cities around the country. By recent estimates, more than a quarter of urban Nicaraguans live below the national poverty line. The government sees UPA not only as a means of improving the urban poor's access to food and reducing levels of poverty, but as fundamental to its policies for developing the family economy and for achieving national food security and food sovereignty. The plan is to establish home gardens and community seed banks, provide urban food producers with training, access to inputs and assistance in marketing their produce, and to develop irrigation technologies to overcome seasonal water scarcities. Much of the groundwork for that forward-looking national policy and the home gardening programme was laid by a project that began in 2010 in two of Managua's poorest and most densely populated areas.

HAAKON S. KROHN

When it rains, it pours in Nicaragua.

Almost all of the country's annual rainfall is recorded between May and November, while much of the dry season, from December to April, is practically rainless. That presented a challenge to a project aimed at introducing backyard gardening in Managua's Los Laureles Sur district and in the municipality of Ciudad Sandino.

Los Laureles Sur has both urban and peri-urban areas and was chosen because of its high rates of food insecurity and malnutrition. A census of first-year primary school children had found that 17 percent were affected by moderate to severe stunting. Ciudad Sandino, located west of the capital, has a population of around 90 000 and is predominantly urban and poor, with most residents living on less than US$2 a day. Households in both areas were consuming less than 60 g of fruit and vegetables per capita per day, or barely 15 percent of the level recommended by FAO and WHO.

The project, which was funded by Spain and implemented by FAO in partnership with the Ministry of Agriculture and Forestry and the city halls of Managua and Ciudad Sandino, invited local residents to sign up for courses in organic gardening at demonstration and training centres (DTCs) created on municipal land in the two project areas.

Each centre is divided into two zones: one for gardens and displays of gardening technologies, including vermiculture and biofertilizer units, greenhouses for seedlings and water storage tanks; the other with a training area, offices and tools and equipment. Training modules covered soil preparation, seeding, agro-ecological management of pests and diseases, irrigation technologies and management, and food safety.

After training, participants received a basic toolkit consisting of a shovel, a pick and a wheelbarrow to use in establishing their home gardens, and a set of weeders, rakes and drills for gardening operations. The demonstration centres were also a source of vegetable seedlings for planting, and of technical advice, when needed. The project technical staff spent two days a week working in the training centres and four days providing direct advice to gardeners at their homes.

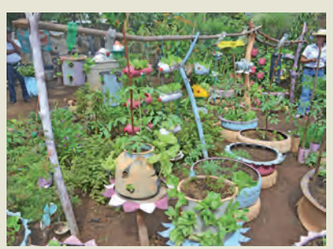
Around 75 percent of the 430 people who joined the project were women, usually household heads who were motivated by the desire to improve the nutrition of their families. In many households, all members of the family participated in digging the garden, or building containers and preparing substrates for microgardening. Some project participants turned their own gardens into mini demonstration centres, where still today many provide training for neighbours.

To enable year-round cultivation of vegetables, it was necessary to find a reliable source of water for use during the six-month dry season. But in both Los Laureles Sur and Ciudad Sandino, streams that cause flooding during the wet season dry up during the dry months. Using the city's piped water supply to grow vegetables was also out of the question: few houses had connections to the network and, in any case, due to high rates of leakage and wastage, water in Managua is heavily rationed. Some neighbourhoods receive service for only two hours a day. And nearby Lake Managua is so polluted from decades of untreated sewage discharge that it will be decades before a recently built treatment plant renders it suitable for use in irrigation.

IN BRIEF: MANAGUA

Managua residents learned eco-friendly gardening practices in training centres, and then applied them in their own backyards. Thanks to year-round production, many families doubled their consumption of vegetables.

1 At the training centre established in Ciudad Sandino (*at right*), the project demonstrated a simple drip irrigation system made from recycled plastic bottles. Above, lettuce is being grown in space-saving plastic tubes. The project also promoted the use of organic fertilizer made from household wastes, and pest control with sticky traps.



2 Used bottles (*left*) form the perimeter of a garden at the Los Laureles Sur training centre. Some project participants turned their gardens into colourful, mini demonstration centres *(above)*, where they provide training for their neighbours. At right, project officials visit a family garden.

Photographs: Eduardo Murillo

To water the backyard gardens, therefore, the project tapped the city's most reliable source of clean, plentiful water – those wet season rains. It did so by installing in the homes of all project participants a rooftop system with the capacity for capturing and storing some 10 000 litres of rainwater per year.

The project calculated that harvesting enough rainwater for a family vegetable garden required a roof area of at least 10 sq m. Each family received a 5 000 litre storage tank connected to a plastic pipe that channels rainwater to the tank from the roof. The pipe has a T-coupling to allow water from the first rains of the wet season to be drained off (that water is likely to contain dust and the wastes of domestic animals and birds that have accumulated on the roof).

The cylindrical storage tanks, which measure from 1.6 m to 2.5 m in height and width, were made by a factory in Managua from two reinforced layers of high-tech plastic resin. The outer layer is coloured black to block the sun's rays and prevent the formation of algae, while the inner layer is composed of a white antibacterial polymer. A tap at the bottom of the tank is connected to a hose or used to fill watering cans. The tanks, which cost the project US$580 each, including pipes, filters and installation, are recyclable and have a useful life of 10 years.

Since each tank can be filled two times or more during the wet season, the 430 tanks installed by the project are able to capture in a year a total of 4.3 million litres of water, which is no longer lost as runoff but used instead to grow vegetables and to help recharge the city's aquifers.

Using rainwater harvesting tanks and drip irrigation systems *(see page 48)*, the training

EDUARDO MURILLO

The project provided 430 rainwater harvesting systems, each linked to a 5 000 litre storage tank

centres in Los Laureles Sur and Ciudad Sandino achieved in 2012 total production of more than 1.5 tonnes of vegetables, mainly tomatoes, carrots and eggplant. Applying what they learned in the DTCs, project participants grew in their own gardens tomatoes, sweet peppers, onions, lettuce, chard, radish, spinach, beets, eggplant, squash, celery, cucumbers, green beans and sweet potato, and herbs such as mint, parsley and basil.

In all, the project invested some US$620 000 in training, infrastructure, water harvesting systems, and the establishment of the demonstration gardens and training centres. An evaluation in 2012 found a high rate of adoption among Managua's urban gardeners of low-cost, resource-conserving and environmentally friendly production technologies and practices.

Growers were using drip irrigation from recycled plastic bottles, and applying mulch made from grass and straw to conserve soil moisture. They enriched the soil of their plots

***Harvesting rainwater** for a family vegetable garden required a roof area of at least 10 sq m*

Drip irrigation made easy

To optimize the use of harvested rainwater, the project devised a low-cost drip irrigation system. Constructing the system requires very simple equipment: discarded plastic soft-drink bottles and lids, a three-inch zinc nail, a hammer, a sharp knife, and plastic drippers used in micro-irrigation systems.

The nail is used to punch a hole in the lid, which is fitted with a dripper and screwed onto the bottle. An incision is then made in the bottom of the bottle so it can be filled with water through a funnel (removing the bottom of the bottles is not advised because they quickly become clogged with dust and debris). The bottles can be mounted in the garden on 30 cm-high wooden poles, or attached to hanging baskets and other containers used in microgardening.

EDUARDO MURILLO

The amount of water released is regulated by adjusting the bottle's position from vertical to 45 degrees, or by inserting a sponge in the neck.

The size of the irrigation bottles is adjusted as the crop grows. A 1.5-litre bottle of water is sufficient to meet the daily needs of a tomato or bell pepper plant for 20 days after transplanting. It is then replaced with a 2-litre bottle and, after 35 days, by a 3-litre bottle. When flowering and fruiting begins, irrigation – and bottle size – is reduced.

And one last piece of advice from the Managua project team: wash the bottles well before using them in the garden: sugar residues attract ants that can damage your crops.

and microgardens with compost, manure and an organic fertilizer made by anaerobically fermenting household wastes, and sowed certified seed of locally recommended varieties. To control pests and diseases, they applied lime and ashes to the soil before sowing, and to leaves during crop growth. To combat whiteflies, they grew grass hedges around their gardens and set sticky traps that used cooking oil as glue.

The evaluation also found that the average consumption of vegetables in gardening families had increased by 60 percent, reaching around 100 g per person per day. The most dramatic improvement was in the Israel Galeano *barrio* of Los Laureles Sur, where consumption increased by more than 160 percent.

To encourage home gardeners to diversify production and consume more fruit and vegetables – and encourage their neighbours to do the same – the Managua project organized food fairs, where visitors sampled a variety of dishes made from fresh, home-grown produce.

Home gardening has not only improved the nutrition of an estimated 2 500 family members, but also saved them money that they would have otherwise spent on buying food. While most households produced only a "relatively modest surplus", 17 percent of those in Ciudad Sandino and 10 percent of those in Los Laureles Sur were able to generate income from the sale of vegetables to neighbours and in local markets.

The project also helped the Ministry of Education develop microgardening in containers in 10 schools. After training, some 2 000 students began cultivating crops such as cabbage, lettuce, tomatoes and peppers in tyres, bottles and even old television sets. The project printed 1 500 manuals on establishing school gardens and used them in short courses for 17 other schools in Managua.

The success of the Managua gardening project prompted the Government of Nicaragua to include urban and peri-urban agriculture in its National Human Development Plan (NHDP) for 2012-2016, and to launch a US$3 million "healthy backyard" programme to encourage urban food production.

The NHDP reaffirms the government's first priority: to ensure that all Nicaraguan families, especially the poor, have access to sufficient, nutritious, healthy and safe food. As part of its strategy to achieve food security and sovereignty, the plan seeks to increase the production, productivity and incomes of farming families, communities and cooperatives. Explicitly included among small and medium food producers are those in urban areas.

The backyard gardening programme, which is implemented by the recently created Ministry of the Family, Community, Cooperative and Associative Economy, promotes healthy food production among urban and peri-urban households, using appropriate technologies and with the participation of families, young people and public institutions.

The Ministry has trained 13 000 youth workers to help participants in the programme and, with FAO assistance, is establishing a total of 13 nurseries in Managua and in provincial capitals for the production of seedlings and for use as training centres.

The Ministry reports that since the programme was launched in Managua's Nueva Nicaragua *barrio* in May 2012, it has helped more than 76 000 households establish gardens of fruit trees, leafy vegetables, spices and local plants such as *malanga*, *chayote* and *achiote*. The target for 2013-2014 is to create a further 120 500 gardens in all of the country's provinces, including 60 000 in Managua alone.

A trader at Managua's Mayoreo fruit and vegetable market. Many gardeners earn income by selling vegetables to neighbours and in local markets

FAO/SAUL PALMA

QUITO

CLAUDE MEISCH

In April 2000, Ecuador's political and economic capital hosted a meeting of local government representatives from nine countries of Latin America and the Caribbean. The outcome was the landmark Quito Declaration, the first to call on the region's cities "to embrace urban agriculture" as a means of reducing poverty, food insecurity and environmental degradation. At the time, food production was widespread in Quito itself. Between 1980 and 2000, waves of Andean indigenous migrants had almost doubled its population, from 780 000 to 1.4 million. In inner-city *barrios* and settlements built on surrounding hillsides and ravines, many of them had resorted to small-scale agriculture to feed their families. Yet Quito's urban agriculture was unrecognized in municipal regulations, only "tolerated" by planners, and not considered in the programmes of the country's Ministry of Agriculture. Much – but not all – of that has changed over the past 14 years.

Thanks to a city-wide participatory urban agriculture project, Quito is one of the region's "greener" capitals, with 140 community vegetable gardens, hundreds of family and institutional gardens, thriving small-scale agribusinesses, and a network of farmers' markets that sell locally grown organic produce. It all began in the neighbourhood of El Panecillo.

El Panecillo *(pictured at left)* is a loaf-shaped hill 200 m high in Quito's historic centre. Most of El Panecillo cannot be built on, owing to its steep slopes, and the surrounding area is home to some 1 900 low-income families, including many internal migrants.

It was there that a pilot programme, launched in September 2000 and co-funded by the municipality and international partners, helped to increase food production in home gardens, promoted the recycling and re-use of organic wastes, and established a community plant nursery. It also developed a microcredit system and implemented four projects – designed with community participation – for produce processing and marketing.

The lessons learned in El Panecillo were used to develop a municipal programme aimed at improving the food security of vulnerable populations in Quito's urban, peri-urban and rural areas. That programme, the Participatory Urban Agriculture Project (Agrupar), was launched in 2002, and was initially managed by the city's Directorate for Sustainable Human Development. Since 2005, it has been implemented by the municipality's Economic Development Agency, Conquito, whose mandate is to create an entrepreneurial, sustainable and innovative city that generates employment and distributes wealth equitably.

Today, Agrupar is one of Conquito's most successful initiatives. It brings together some 12 250 urban and peri-urban farmers and 380 community-based organizations, supported by

IN BRIEF: QUITO

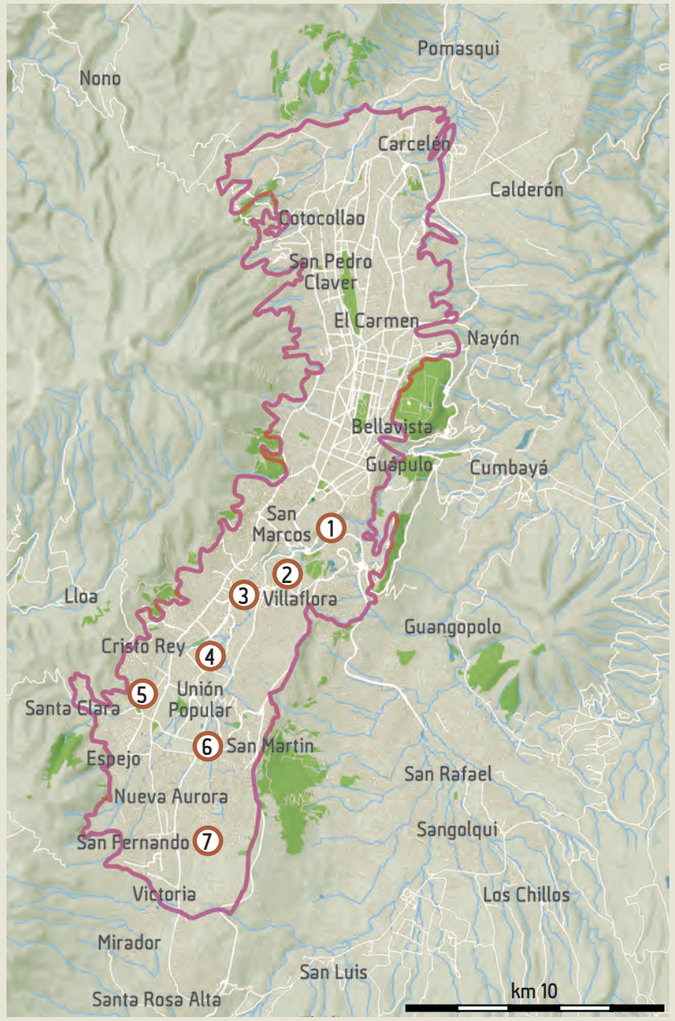
The Quito government's urban agriculture programme provides residents of the city's 32 urban parishes with seeds and seedlings, inputs and equipment, management training, and poultry, guinea pigs and bees.

1 In Itchimbía parish, central Quito, there is space for raising chickens and growing tomatoes. Many people take up agriculture in order to save money on food purchases.

2 A demonstration garden and greenhouse created by the AGRUPAR project in Chimbacalle, in the city centre.

3 Cabbage, carrots and lettuce grown in urban gardens provide healthy food for children.

4 The roadside Eugenio Espejo community garden produces beets, chives, lettuce and flowers.



5 At a school in Chillogallo, in southwest Quito, children grow their own vegetables in a plot they named "Gardenland".

6 Customers at one of the city's 14 organic produce markets, in Quitumbe, see "where their money goes" and how it benefits urban farming families.

7 A family greenhouse in Turubamba parish, southern Quito. In 2013, around 100 micro-greenhouses had been set up in the city.

Photographs: AGRUPAR

local and national government departments, universities, development cooperation agencies and NGOs, and the private sector. Its primary focus is on enhancing food security and promoting food processing, access to microcredit, microenterprise management and marketing.

AGRUPAR is operational in all eight administrative zones of the Metropolitan District of Quito. Agriculture is practised by community groups, families and schools, in centres for the elderly, single mothers, abandoned children, migrants and refugees, in social rehabilitation and health centres, in centres for the disabled and in religious communities. At last count, the project had helped establish 1 072 active gardens – including 140 community gardens, more than 800 family gardens, and 128 gardens in schools and other institutions – as well as 314 livestock production units. Annual food crop production is estimated at 400 tonnes.

Project participants include rural people who have migrated to the city and for whom gardening and raising animals is a means of surviving in an often hostile environment, and maintaining their rural roots and traditional knowledge. Many others are underemployed workers who take up agriculture in order to save money on food purchases and make extra income from the sale of surpluses. Around 86 percent of participants are women.

The average income of households joining the project is around US$350 per month, well below the minimum needed to feed a household, which is set at US$600. Most participants have completed only primary school.

Joining AGRUPAR usually requires the formation of a group of at least six people – friends, relatives, neighbours or residents

AGRUPAR

Residents of the Valle de los Chillos, a peri-urban area east of Quito, have started community gardens with assistance from the AGRUPAR project

of institutions – who apply for assistance in establishing their garden. They need to have enough space for an in-ground plot or for microgardening, access to clean water, and the commitment and spare time (at least 12 hours a week) needed to care for their crops.

The staff of Agrupar then provide seeds and seedlings, conduct technical training on agricultural production, and help to develop participants' management skills. People who maintain an active garden can access further training in nutrition, food processing and marketing, and the breeding of animals.

Between 2004 and 2012, the project provided training for more than 7 350 people. Services are provided under a symbolic pricing policy, with each training session costing Us$0.50 per person. The municipality's annual contribution to the Agrupar project – some Us$250 000 a year – meets the cost of training, technical advice and logistics. It also covers part of the costs of seed, inputs and equipment, and animals such as poultry, guinea pigs and bees. However, while Quito's city government remains the main source of funding, around half of investment in productive infrastructure – such as micro-greenhouses and small sheds for animal husbandry – comes from participants.

The project actively promotes production that meets Ecuador's standards for organic agriculture, which require holistic production systems that enhance biodiversity, biological cycles and soil health, prohibit the use of GMOs, and control pests without chemicals. The Agrupar project is registered as a producer and marketer of organic produce at national level and shares the cost of certification with producers.

More than 90 percent of gardens are less than 500 sq m in size, and a little over half are less than 100 sq m. The cost of establishing a basic 100 sq m urban garden for organic production is around Us$80, including tools, seed, fertilizer, fencing and access to water. Incorporating drip irrigation and a micro-greenhouse costs an additional Us$480. By 2013, drip irrigation systems had been installed in 70 gardens, and growers were using around 100 micro-greenhouses.

Crops grown in the city's *huertas* range from potatoes, maize and quinoa to vegetables – mainly swiss chard, broccoli, cabbage, tomatoes and carrots – as well as aromatic plants, spices, and fruit such as lemons, passion fruit, babaco and blackberries. Gardeners are encouraged to use environmentally friendly cultivation practices: maintaining soil health with compost and green manure, rotating crops, protecting soil with cover crops and live barriers, and irrigating with potable water or harvested rainwater. Animal husbandry is promoted as a source of income, protein and manure.

Where little land is available for horticulture, Agrupar promotes alternatives such as vertical gardens on walls, and microgardening in recycled containers, such as bottles, boxes and tyres, which permits food production on terraces, balconies and patios.

The project estimates that about 47 percent of garden produce is sold; the rest is kept for home consumption. Participants earn at least Us$55 a month from the sale of surpluses and make a further saving of at least Us$72 a month on food purchases. Total savings are 2.5 times the value of the government's human development voucher, which provides Us$50 a month to vulnerable households.

Urban agriculture has helped diversify the diet of urban farmers and their families. Surveys have identified in family diets more than 100 types of fresh and processed products, including vegetables, herbs, roots and grasses, flour and canned meat. Agrupar has worked closely with a research centre to identify and disseminate potato varieties that are better adapted to urban conditions and have high levels of zinc and iron.

Among the environmental benefits of urban agriculture is the conservation of biodiversity – some 50 edible plant species are maintained in Quito's urban gardens. In addition, each gardening family recycles on average 12.5 kg of kitchen scraps per week as compost. An estimated 1 820 tonnes of organic wastes are recycled each year by Agrupar project

Farmer meets consumer at ***bioferias***

A notable AGRUPAR innovation has been the opening of organic produce markets – or *bioferias* – that have become sources of healthy food for Quito residents and a practical example of Ecuador's solidarity economy. The city now has 14 one-day *bioferias*, open weekly between Thursday and Sunday.

To ensure the widest possible availability and consumption of organic food produced in urban gardens, *bioferias* are located in low-income neighbourhoods and peri-urban zones, as well as in better-off parts of the city.

Direct sale of produce through the markets encourages fair prices and creates a high level of trust between producers and their customers. Gardeners get to know the people who buy their produce, while consumers see "where their money goes" and how it benefits urban farming families.

In 2012, the *bioferias* of Quito sold more than 100 tonnes of organic produce (valued at US$176 000), which amounts to one quarter of the project's total estimated garden production.

AGRUPAR

An organic produce market at La Carolina park, in the north of urban Quito

Among the benefits of urban agriculture is the ***conservation of biodiversity***

participants. The increased availability of fresh produce also means less need to transport it from rural areas, which generates fuel savings and reduces air pollution.

As urban food producers achieve household food security, Agrupar encourages them to form microenterprises based on horticulture, animal husbandry, food processing and the production of organic inputs, and trains them in business planning, marketing, and accounting.

In fact, adding value to surplus production has recently become one of the most innovative features of Quito's urban agriculture, generating revenue and providing full- or part-time employment for half of the project participants.

Through community organizations, urban farmers have entered various links in the value chain, not only as primary producers but also as intermediate or final processors of products such as meat, canned goods, dairy foods and snacks.

Many farmers now supply certified organic chili and tomato paste to local food processing companies, and free-range chicken meat to restaurants. Certified organic vegetables, such as carrots, radishes, beetroot, lettuce and broccoli, are sold through farmers' markets *(see page 55)*. Farmers' associations offer home delivery of organic food baskets, which contain vegetables, fruit, herbs, pickles, jams and bread.

To help producers meet food quality and safety standards, Agrupar has introduced improved processing technologies and the use of containers, packaging and labels, and facilitated access to higher-volume markets, such as private and public institutions.

For those urban famers who lack the capital to invest in micro-enterprises, the project helped to establish 35 grassroots investment societies, to which members each contribute between US$10 and US$20 in start-up capital. Thanks to the high profitability of the sale of organic vegetables, the producers have built up savings that they invest in greenhouses, irrigation systems and livestock.

Market opportunities are also emerging with Ecuador's "inclusive business" movement, which encourages large businesses to link up with small-scale suppliers, such as farmer organizations, provided their produce meets quality standards, is delivered on time and is accompanied by an invoice. But those opportunities present many urban farmers with a dilemma: entering profitable value chains creates tax obligations and could mean the loss of the government's monthly human development voucher.

Future development of Upa in Quito will see an increasing focus on sustainable intensification and the use of more productive technologies. With greater diversification and quality certification, marketing options will expand beyond farmers' markets to supermarkets and specialized outlets.

Increasing the area covered by the project will require not only greater support from local and international partners, but also a higher level of participation by urban farmers themselves in the provision of labour, land, materials, tools, seeds, seedlings, inputs and basic infrastructure.

Since an estimated 30 percent of urban Quito is vacant land, development of agriculture in the city will also require a review of its cadastre to identify municipal areas that could be allocated for agricultural use, and measures to extend the concession of urban space to producers.

Quito's experience has shown that intensive agriculture is feasible in an urban environment, and that it helps reduce malnutrition in poor households, strengthens household food security and generates employment and income.

For the municipal government, Agrupar is a flagship project of its social inclusion policy and its vision of competitive economic development. The project's expertise has been used to help establish school gardens in support of the municipality's programme for "healthy schools", and the Ministry of Agriculture recently partnered with Agrupar in implementing the national nutrition strategy in areas with high levels of child malnutrition.

Given Quito's current poverty rate of 27 percent – and projections that the city's population will grow from the current 2.2 million to more than 2.8 million by 2022 – agriculture needs to become a key element in other municipal programmes for education, health, environmental protection and social inclusion. Agrupar could also serve as a model for similar programmes in other cities, and the basis for a national policy and programme for Upa.

Yet, 14 years after the seeds of the programme were sown in El Panecillo, agriculture in Quito still lacks a regulatory framework that would recognize urban farmers as legitimate stakeholders in the city's social and economic development, and allocate vacant urban land for food production.

While Quito's Development Plan, 2012-2022, calls for an equitable, sustainable and participatory city – and envisages a "green Quito" that would improve environmental quality and help to mitigate the effects of climate change – it makes no specific mention of urban agriculture, or even *huertas*.

Continuing constraints to Upa development in Quito reflect the absence of policy and financial support from the national level. In Ecuador, agricultural development programmes focus on rural areas. It is difficult for urban farmers in Quito to register their associations, which restricts their access to land, since municipal land is granted only to legally recognized entities. There are no specialized services to provide them with technical advice or credit and they are excluded from national programmes for input supply and the regularization of land tenure.

For that reason, the project has proposed the inclusion of urban and peri-urban agriculture in Ecuador's food sovereignty law, adopted in 2009, which establishes the legal obligation of the State to ensure that individuals, communities and peoples achieve food self-sufficiency.

Where it all began. Local residents still harvest lettuce on El Panecillo

AGRUPAR

LIMA

Rising at an altitude of 5 200 m in the Peruvian Andes, the River Rímac carves a path of 200 km down to the coastal desert, through the city of Lima and into the Pacific Ocean. The Rímac is the lifeline of Lima's water supply, providing most of the drinking water of its 9.6 million inhabitants, and used to irrigate much of its 12 500 ha of peri-urban farm land. It is also the Lima region's main means of waste disposal – the discharge of untreated effluent from mines, factories and human settlements has led to levels of contamination that have been described as "catastrophic". As its population grows, at the rate of almost 200 000 a year, Lima has become increasingly vulnerable to water scarcity, which will be aggravated by climate change. Meanwhile, rising incomes are creating demand for a greater variety and higher quality of food, even as urban expansion pushes agriculture onto less productive land. A recent urban water management study proposed a "grey-to-green" solution: to reduce stress on Lima's water resources – and boost food production – by treating and re-using 300 million tonnes of wastewater a year to irrigate the city's green belts and farmland.

DAVID ALMEIDA

INTENSIVE AGRICULTURE was the foundation of the civilizations that emerged on Peru's arid central coast 7 000 years ago. The abundant waters of the Rímac River and the rivers of Chillón to the north and Lurín in the south – along with the region's shallow water table, its fertile valley soils and stable climate – favoured the irrigated production of cotton, maize, beans, sweet potatoes and vegetables throughout the year. In the early 20th century, agricultural land in what is today the metropolitan area of Lima totalled some 600 sq km.

Lima is now the fifth largest city in Latin America, home to almost one-third of Peru's population, and – with an annual rainfall of just 25 mm – the world's second biggest desert city after Cairo. Since 1950, the mass migration of rural people from the country's highlands has increased its population nine times over. In the past 30 years, the urbanized area has expanded by more than 200 sq km and it is expected to increase by more than 16 sq km a year until at least 2020.

Although an estimated 17.5 percent of Lima's residents – or more than 1.5 million people – are poor, the living conditions of many more have improved remarkably in recent years. Since 2000, Peru has had one of the region's fastest growing economies, and 60 percent of the capital's population is now considered "middle class". Economic growth and higher incomes have fuelled the buying up of agricultural land for housing, industry and infrastructure, while urban land prices have soared (according to one report, the average price of land for new office buildings and apartments in Lima rose by almost 50 percent in 2012-2013).

Along with economic prosperity and urban growth, Lima's agricultural area has shrunk to about 125 sq km. Urbanization has taken out of production some of its best farmland and, in recent years, has claimed large tracts of uncultivated land in the lower reaches of the Rímac, Lurín and Chillón River basins. Agriculture is being displaced to areas which lack the fertility, adaptability and performance of coastal valley soils, which will lead not only to more lengthy distribution channels, but also to the risk of shortages of some produce.

Population growth has also increased pressure on the city's water resources, with further negative consequences for agriculture. Around 80 percent of water captured from the three rivers, and almost all of the city's groundwater – making an annual total of some 600 billion litres – are destined for human consumption and industry. In addition, Lima's human population and its factories produce large volumes of solid and liquid wastes that are dumped into canals and rivers, leading to high levels of contamination of crop irrigation water. Until very

IN BRIEF: LIMA

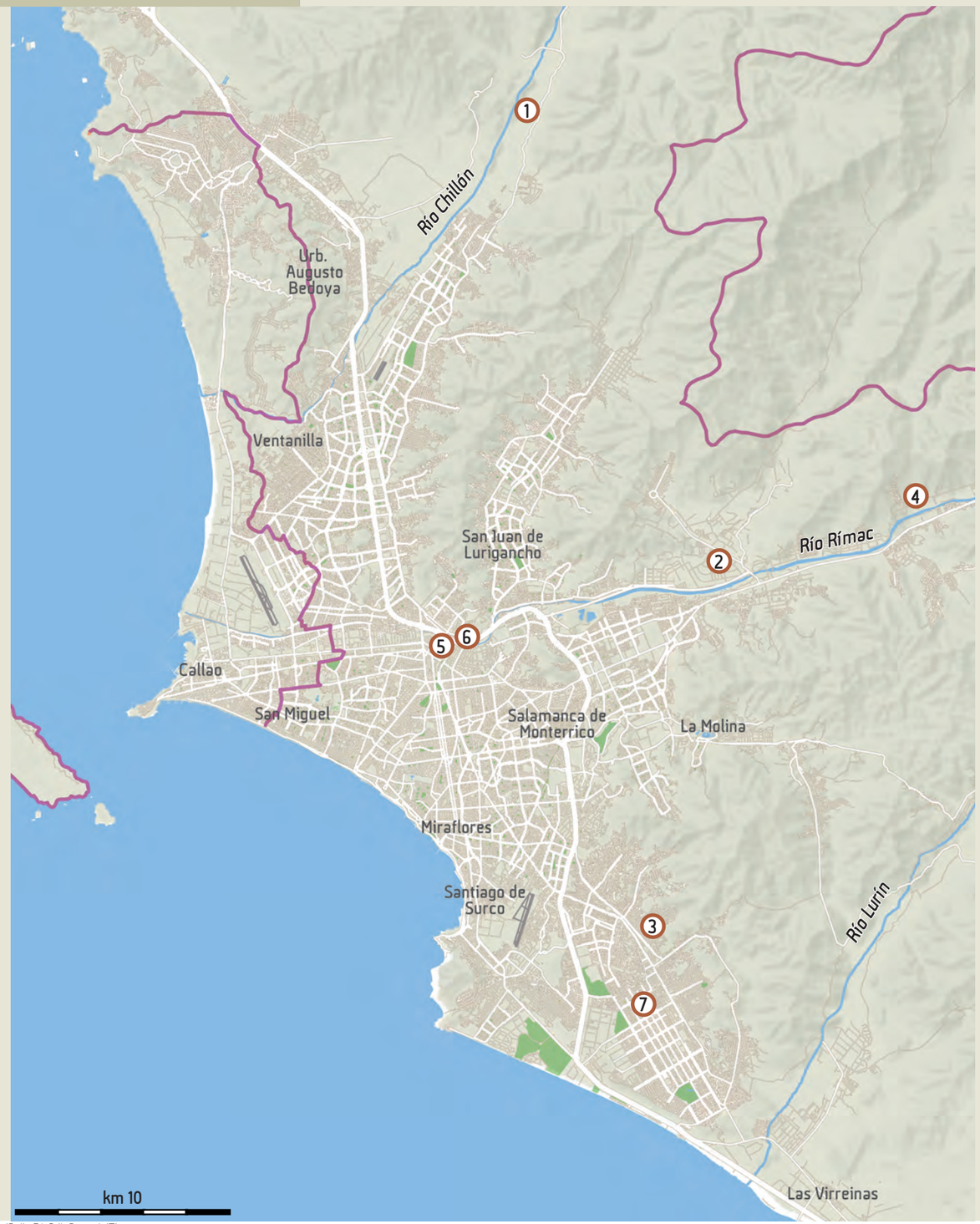
The Government of Metropolitan Lima has launched a programme to promote urban agriculture in all 43 of the city's districts. But action is also needed to protect its fertile peri-urban farmland from exponential urban growth.

1 Farmers in their field of quinoa in the Chillón River Valley, 15 km from the centre of Lima. Agriculture around the city produces a wide range of crops, including vegetables, fruit, ornamental plants, maize and fodder.

2 At Lurigancho, on Lima's outskirts, farming communities raise pigs for meat and use biodigestors to turn manure into methane gas.

3 Urban farmers sell vegetables, cakes and sweets in Villa María del Triunfo, one of the city's low-income residential districts.

4 A farmers' market at a town along the Rímac River. By 2025, urban sprawl is expected to have expanded beyond the Rímac, Chillón and Lurín River basins.



5 Harvesting crops from a rooftop community garden in Lima's *Centro Histórico*. The garden was installed as part of Lima's urban agriculture programme.

6 A freshly planted vegetable garden in the 2.5 ha Parque de la Muralla, near the city centre.

7 Students of the Divina Misericordia School in Villa El Salvador, where an FAO project helped create a vegetable garden.

Photographs: Lima Regional Directorate of Agriculture (1,4), IPES/RUAF (2,3), Metropolitan Municipality of Lima (5,6), FAO/J. Razuri (7)

recently, less than 10 percent of the 550 billion litres of wastewater generated each year was treated.

Agriculture is practised in peripheral zones north, east and south of Lima, and most extensively in the districts of Carabayllo, Puente Piedra, Pachacamac, Lurín, Lurigancho Chosica and Ate Vitarte. It is the main source of income for many settlers from rural areas, and provides temporary employment for Lima's urban poor. Many work as unskilled labourers for landowners, while others rent a small plot for cultivation and sell the produce. Although farm sizes range up to 600 ha, about 60 percent of holdings are less than 1 ha and 43 percent are less than 1 000 sq m.

Peri-urban farming produces a wide range of crops – mainly vegetables, fruit, ornamental plants, maize and fodder. In 2007, more than 5 000 ha of irrigated land in the Rímac, Chillón and Lurín River basins were being used to grow vegetables for sale in the capital's markets. Production systems are very dynamic, with farmers sowing simultaneously a wide range of short-cycle vegetables to take advantage of changing market demand, and practising continuous crop rotation to optimize land use.

A 2007 study of peri-urban crop production found that less than 200 ha of cropland were irrigated with water that had been filtered by local treatment plants. The rest drew on river water and untreated wastewater, which are often highly polluted with heavy metals, parasites and faecal bacteria.

Health concerns are also associated with the thriving small-scale pig farming industry that has developed, using municipal wastes as feed, in

FAO

Pig farms win reprieve

Isolated settler communities in the hills around Lima have developed a highly efficient system of pig production in response to increasing demand for foods of animal origin. However, the inexorable expansion of the city limits has often brought pig farmers into conflict with new neighbours and the health authorities.

That is what has happened in the Saracoto Alto settlement in Lima's Lurigancho district. When the first pigsties were built there in the 1980s, the area was still at a safe distance from population centres. Out of sight of health inspectors, settlers organized themselves in an informal association and raised their animals with little regard for sanitation. It was common practice, for example, to dump dead pigs in the dry bed of the nearby Huaycoloro River.

After urban sprawl finally reached the foothills in the early 2000s, complaints about the health risks to neighbours, consumers and the producers themselves prompted the Ministry of Health to order the immediate closure of the pig farms, which were the main source of income for 140 families.

The families appealed to the newly created Lurigancho district office for urban agriculture, which convened a roundtable dialogue between the farmers' association and municipal authorities. They signed an agreement under which the office organized training for the farmers in pig management, especially sanitation. Since then, many farmers have adopted good production practices, such as vaccinating their animals, providing them with a healthier diet, safely disposing of pig wastes and building concrete sties.

marginal and often illegally occupied communal areas, where it provides employment for a large number of settler families *(see page 62)*. Pig farmers work in precarious conditions, and several studies have found that harmful residues in the animals' feed pose a health risk to both the producers and consumers.

Within the city's built-up area, food production is practised in family plots as small as 4 sq m and in community gardens of up to 1 000 sq m, mainly in the southern districts of Chorrillos, Villa El Salvador and Surco. As well as growing vegetables and fruit, many residents raise guinea pigs and poultry on garden wastes and scraps from the kitchen.

Urban farmers use almost no chemicals and irrigate their crops with drinking water. Production is usually for home consumption – only a few farmers have installed hydroponic systems for the production of high-value vegetables for sale to supermarkets or at organic food fairs.

JIFSAN

Agronomists attend an open-air workshop on good horticultural practices, at a strawberry farm outside Lima

While no reliable data is available on the number or the socio-economic conditions of residents of Lima involved in urban and peri-urban agriculture, it is practised in areas with generally high rates of poverty. Studies have found that farming families are more likely to have a diversified diet based on fresh, home-grown produce supplemented by purchased foods.

In fact, the local production of a wide range of plant and animal foods is believed to play an important role in child nutrition in Lima, where rates of child malnutrition are half the national average.

Sustainable development of agriculture in and around Lima requires stronger government support. First, the benefits of food production in urban areas need to be recognized and prioritized in national policies.

For many years, the institutions most active in promoting urban agriculture and its inclusion on the political agenda were NGOs, research centres, international organizations and some private companies. Their activities persuaded the local governments of Lima's Villa María del Triunfo, Chosica Lurigancho and Villa el Salvador districts to incorporate agriculture in their urban development programmes, sometimes as part of civic beautification projects.

A more recent positive development was the adoption by the Metropolitan Lima Municipal Council in September 2012 of an ordinance for the promotion of urban agriculture, which it defines as "a strategy for environmental

*Production systems are **very dynamic**, with farmers sowing a wide range of short-cycle vegetables*

Lettuce, beets, carrots and broccoli

At the Divina Misericordia school in the southern Lima district of Villa El Salvador, an FAO project helped establish a school garden used by students to grow lettuce, beets, carrots and broccoli. Teachers, students and parents built the garden from scratch, transporting soil to the site and installing an irrigation system.

FAO/J. RAZURI

management, food security, social inclusion and local economic development". The ordinance, which is applicable in all 43 districts of Lima Province, also establishes a metropolitan urban agriculture programme which will include the use of public spaces for food production.

However, there is no clear national public policy that recognizes and promotes urban agriculture or regulates its incorporation into the overall strategic planning of Peruvian cities. The national Ministry of Housing, Construction and Sanitation has established policies and procedures for urban development, but has issued no regulations concerning agriculture in urban areas. In developing cities such as Lima, agriculture will only be profitable, competitive and sustainable when there are also clear mechanisms for zoning land for agricultural use, along with tax benefits for producers, supportive pricing of inputs, and assistance in accessing profitable and stable markets.

Action is also urgently needed to protect and enhance Lima's peri-urban agriculture, which suffers major limitations, including a lack of fertile land and clean water for irrigation. Projections indicate that by 2025 the metropolitan area will have a population of 11.5 million and that urban sprawl will have expanded beyond the Rímac, Chillón and Lurín River basins.

Along with urban growth, it is expected that the pressure on land and water resources currently used for agriculture will increase exponentially.

At the same time, Lima's population growth and economic development is driving unprecedented demand for a greater variety and higher quality of food. Recent years have seen the spread of neighbourhood food warehouses, wholesale produce markets and large supermarkets in all areas of the capital. The increased sophistication and modernization of markets presents an opportunity for urban and peri-urban agriculture to become the main supplier of fresh, healthy "local food" for consumers.

The challenge is to create the necessary conditions to allow urban and peri-urban agriculture to realize its full potential as a key sector for ensuring Lima's food and nutrition security, and as one that generates other benefits for society by conserving natural resources and safeguarding public health.

METROPOLITAN MUNICIPALITY OF LIMA

A family that grows together in a community garden in central Lima

With the creation of the national Ministry of Environment in 2008, Peru has caught up with international standards in environmental policy. Since municipal governments are responsible for local implementation of environmental protection regulations, Lima should promote agriculture as an activity that improves environmental quality through its productive re-use of the city's sewage and solid waste.

When appropriately treated, wastewater from domestic sources can be used safely to irrigate fruit trees, vegetables and ornamental plants. Since it contains nutrients such as organic carbon, nitrogen, phosphorus and potassium, it permits more intensive use of land and improves plant vigour. Wastewater is something Lima has in abundance.

The good news is that Lima no longer discharges more than 80 percent of its sewage water directly into the ocean without prior filtering or treatment. In February 2013, the Peruvian government inaugurated the US$160 million Taboada treatment plant, the largest in South America, with the capacity to treat 75 percent of the municipal area's effluent before discharging it into the sea through a 3.5 km-long underground pipeline.

Work also began in 2013 on another plant in La Chira, in the south of Lima, which is expected to be completed late in 2014, boosting coverage to 100 percent. The government also announced "future plans" to use the treated water for watering parks and gardens.

That revolution in wastewater treatment opens the way for the re-use of the city's liquid and solid wastes as irrigation water and organic fertilizer for the production of food on the city outskirts, especially in uncultivated and abandoned farming areas. A recent urban water management study, funded by the European Commission, calculated that by re-using slightly more than half of its treated wastewater, Lima could irrigate parks and green areas of 28 000 ha and some 10 800 ha of farmland.

That rate of irrigation, which amounts to 8 million litres per hectare per year, would help increase yields and the quality of produce, and generate jobs and income. By reducing competition from agriculture, it would also increase the supply of clean drinking water available to city residents.

*Pressure on **land and water resources** currently used for agriculture will increase exponentially*

EL ALTO

Thirty years ago, El Alto was a dormitory suburb, inhabited by mining families and migrants from rural areas, on the plateau that lies at an altitude of 4 000 m above the city of La Paz. Since then, its population has almost tripled, from 300 000 to 890 000. Today, it is the second biggest municipality in the Plurinational State of Bolivia, after Santa Cruz, and together with La Paz forms the country's most populous urban agglomeration. In the early 2000s, more than 70 percent of the population lived in poverty and 12 percent of families were indigent. Around 40 percent of El Alto's children under five years were malnourished, the consequence of extremely low consumption of animal protein, fruit and vegetables. To improve food and nutrition security in the city, FAO and El Alto's municipal government launched a project, funded by Belgium, aimed at promoting the year-round production of vegetables in family gardens. That experiment in urban agriculture has had a lasting, positive impact in the city's poorest neighbourhoods and has helped find a place for UPA in Bolivia's National Food and Nutrition Policy.

ALHEN

EVEN ON A SUNNY, SUMMER DAY in El Alto, the average temperature rarely exceeds 13°C. But inside the hundreds of mud-brick greenhouses that dot the city, gardeners work in temperatures of around 30°C, which create ideal growing conditions for luxuriant beds of lettuce, Swiss chard, spinach, tomatoes, rosemary, coriander and strawberries.

In the neighbourhood of San Roque, on the city's outskirts, 90 women cultivate 15 different types of vegetables and herbs, mainly for home consumption but increasingly with an eye to city markets, where their organically grown produce fetches good prices. Recently, some of the women built three new greenhouses, and plan to sell 70 percent of what they grow at local fairs. At current prices, sales of vegetables from a typical 40 sq m greenhouse would earn them at least US$560 a year.

El Alto's backyard greenhouses have become symbols of urban agriculture on the Bolivian *altiplano*, the 125 000 sq km Andean plateau that is home to an estimated 4 million people. In fact, the region's low and irregular rainfall, average night-time temperatures near zero and year-round frosts make production of many garden plants – including lettuce, Swiss chard, spinach and tomatoes – virtually impossible *without* greenhouses.

Between 2004 and 2008, the El Alto gardening project invested US$700 000 in establishing, in nine districts of the city, 1 187 family greenhouses and training low-income residents in horticultural production techniques adapted to the city's agroclimatic conditions. To ensure sustainability, it also sought to assist the municipal government in drafting strategic guidelines for the further development of urban and peri-urban horticulture. One of the first initiatives of the municipality's Environment Department was to create a *Unidad de Microhuertas Populares*.

Residents needed to have at least 30 sq m of free space for a greenhouse, and at least two hours of free time daily for gardening, to join in project activities. Other requirements included a permanent source of good quality water and "natural light for at least five hours a day". Participants were also expected to contribute their labour and 40 percent of the cost of materials for the infrastructure.

From the outset, the project had an "open door" policy that encouraged the participation of community organizations, public agencies and other interested parties. That approach helped to create a network of collaborators, including the agronomy faculties of two universities, church organizations, microcredit institutions, youth rehabilitation centres and private companies.

The project established three demonstration and training centres (DTCs), where agronomists tested and evaluated 54 species of vegetables, fruit, herbs and spices for greenhouse production, and 14 different types of containers for use in microgardening.

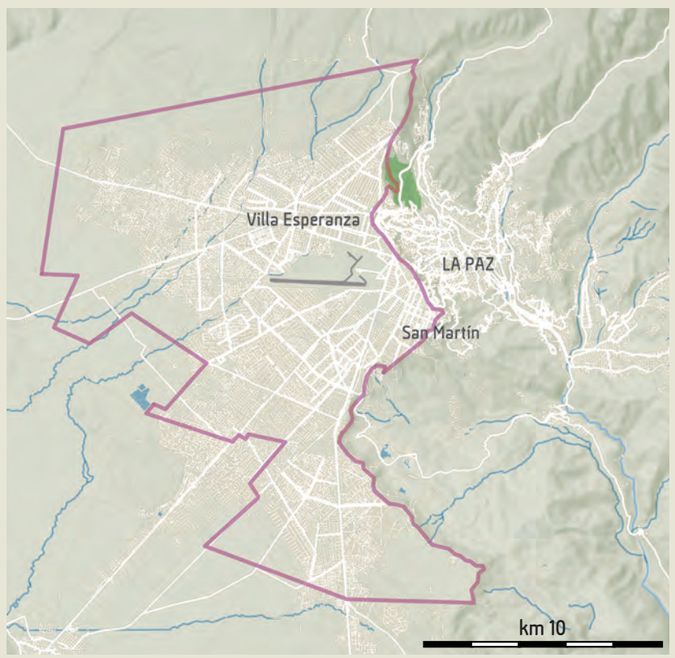
Through workshops in the DTCs, participants learned basic gardening skills and were sensitized to the need to improve the quality of family diets. In all, the project provided training to some 2 000 home gardeners, the majority of them women, in greenhouse construction and maintenance, hydroponic production, composting, biological pest and disease management, irrigation, and best practices in post-harvest handling.

IN BRIEF: EL ALTO

In one year, a typical greenhouse in El Alto produces six crops of chard and radish, and almost 1 tonne of tomatoes. Gardeners save US$60 a month on food purchases and make US$15 from the sale of surpluses.

A gardener in her greenhouse. Known locally as *carpas solares*, greenhouses are essential for horticulture in El Alto's rigorous climate.

The garden inside at 24 sq m greenhouse can produce enough vegetables for a family of five.



Daytime greenhouse temperatures reach 32.6°C, creating ideal conditions for vegetables in hydroponic gardens and containers.

The project introduced nutrient-rich vegetables that were previously unknown, such as white radish.

Surface mulch and drip irrigation from plastic bottles reduced water needs by up to 80 percent.

The project promoted home raising of guinea pigs, a rich source of high quality protein.

Photographs: Juan José Estrada Paredes, IPES/RUAF (top, bottom right)

Solar-heated greenhouses – known locally as *carpas solares* – were essential for gardening in El Alto's rigorous climate. The project developed two basic models: a structure with a sloping roof of agrofilm or corrugated plastic, facing north, and a simple tunnel greenhouse made with iron hoops and agrofilm for windier areas. (It also designed a fully portable model for use by people in rented accommodation.)

The ground area of the greenhouse, at 24 sq m, is sufficient to meet the needs of a family of five. Construction costs were around Us$580 per greenhouse, with the project covering around 60 percent; beneficiaries provided labour and locally made building materials, such as sundried mud bricks.

By retaining warm air heated during daylight hours by solar radiation, the greenhouses allowed continuous production of a wide variety of vegetables and up to six harvests per year, depending on the crop. Extra warmth was provided by sawdust-fuelled stoves, and by water containers painted black, which accumulated heat during the day and released it during the night.

Tests showed that the temperature inside greenhouses was normally 10°C higher than outside. During freezing nights on the *altiplano*, when the thermometer dropped to -5°C, the temperature inside was 4.2°C. Daytime greenhouse temperatures sometimes reached 32.6°C.

In their *carpas solares*, families cultivated up to 32 recommended plant species, including nutrient-rich vegetables that were previously unknown in El Alto, such as spinach. To increase greenhouse output, families were trained in growing vegetables in a wide range of used containers – including old CD players, pots, shoes and helmets – fixed to the walls and hanging from the ceiling.

Since gardeners and their families were in daily contact with crops, pesticides were not used. Among safe alternatives introduced by the project were wild lupines – very abundant on the *altiplano* – to discourage aphids, and capsicum to ward off whiteflies. The project also introduced the composting of wastes from kitchens and greenhouses to make organic fertilizer (because composting units were in open fields, exposed to night-time frosts, decomposition took up to six months).

To reduce water consumption, the project promoted practices such as mulching which, by slowing the rate of soil moisture evaporation, was found to reduce water requirements from 5 litres per sq m to around 3 litres. Drip irrigation from plastic bottles, tailored to the root development stage of each crop, reduced irrigation needs to 2 litres. By carefully managing the water cycle in their greenhouses, some gardeners were able to obtain good harvests using just 1 litre of water per sq m per day.

To ensure the availability of good quality inputs, the project helped to establish a network of community seed shops – which distribute seed bought in bulk by the municipal government – and provided the capital to set up 18 family-run input supply stores. It also encouraged home raising of guinea pigs, which are native to the Andes and are a rich source of high quality protein, by introducing improved breeds and production methods to 250 families and conducting trials of greenhouse production of forage to feed them.

The El Alto greenhouses proved to be highly productive, with growers able to harvest six crops

The project introduced the ***composting of wastes*** *from kitchens and greenhouses to make organic fertilizer*

a year of chard and radish, and five crops of tomatoes. In one year, a 24 sq m greenhouse can produce almost 1 tonne of tomatoes, 460 kg of lettuce and 260 kg of paprika.

As production increased, many families began to generate surpluses and to sell their produce informally. Following a feasibility study, 70 families were trained in post-harvest handling and packaging and the project helped to create a brand, "Verdurita", for the marketing of high-quality vegetables in El Alto and La Paz. By December 2008, a stable group of 20 women were selling produce to outlets such as restaurants and supermarkets, earning a monthly income of US$32 per greenhouse.

Six years after termination of the project, home gardening in greenhouses remains a widespread activity in the city. A survey conducted in 2013 found that production of vegetables saved the average gardening family some US$60 a month on food purchases. Around 70 percent of gardeners also sell surplus produce, generating cash income of about US$15 a month. In greenhouses where crops are also grown in containers, monthly output can be worth up to US$100.

What accounts for that sustainability? First, while the project encouraged group approaches to marketing, training and technical assistance, it found that vegetable gardening was more productive and sustainable when carried out by individual households – horticulture is an intensive activity, and collective production was more difficult to organize.

The project's "open door" policy also proved to be one of the keys to its success. Many of the organizations that participated in its activities have continued to provide support to the development of urban agriculture in El Alto, and are replicating the greenhouse technology that was developed in the demonstration and training centres. For example, one local private company established a 120 sq m garden that is used by its employees and also serves as a demonstration centre.

Creative hanging gardens

El Alto families were trained in growing vegetables in a wide range of used containers – including old CD players, pots, shoes and helmets – fixed to the walls and hanging from the ceiling.

JUAN JOSÉ ESTRADA PAREDES

JUAN JOSÉ ESTRADA PAREDES

Another key factor was the project's participatory approach to capacity building, which focused not only on vegetable production but – above all – on raising awareness among low-income residents of the importance of nutrition and the need for healthier family diets. The effectiveness of nutrition education was underscored by an evaluation in 2010, which found that the intake of calcium, iron, B vitamins and vitamin C among beneficiary families was "notably superior" to the baseline. The money households once spent on buying vegetables is now used to buy meat, eggs and milk, which were previously eaten only "on very special occasions".

The support and political will of the El Alto municipal government were also decisive. During project implementation, the municipality's gardening unit used its own resources and personnel to build 150 greenhouses, and is now responsible for promoting and coordinating all agricultural activities in the city.

The most lasting benefit of urban and peri-urban agriculture in El Alto has been placing UPA high on the political agenda in Bolivia, from local to national level. Similar projects have been launched since in other cities of the *altiplano*. In neighbouring La Paz, the municipal government and FAO helped to establish 150 peri-urban greenhouses of 60 sq m each; big enough to produce surpluses for sale. In the city of Oruro, another initiative established a demonstration and training centre that is being used to train 1 000 low-income families in greenhouse horticulture.

JUAN JOSÉ ESTRADA PAREDES

Vegetables grown in El Alto greenhouses are sold in La Paz markets under the trade name "Verdurita"

Another El Alto initiative that has been extended through projects to other towns and cities of Bolivia is the raising of guinea pigs and other small animals, and its community seed shops have been replicated in both urban and rural areas.

In 2009, Bolivia recognized the right to food in its constitution, and the government is finalizing a National Food and Nutrition Policy that is expected to include a programme for urban and peri-urban agriculture. Bolivia's Ministry of Productive Development and Plural Economy are already developing such a programme, in collaboration with FAO. When it is launched in 2014, the programme will provide technical assistance and inputs for family greenhouse production in 13 municipalities, both for home consumption and, eventually, as a source of fresh produce for major cities such as La Paz, Cochabamba, Santa Cruz and Sucre.

In El Alto itself, the municipal government adopted as a public policy in August 2013 the promotion of agricultural and livestock production in its urban and peri-urban areas. The main objective of the policy is to reduce levels of malnutrition and to generate employment and economic resources for El Alto families, through the sale of vegetables and small livestock.

The project raised awareness among low-income residents of the need for ***healthier family diets***

BELO HORIZONTE

LEO DRUMOND

Brazil has become the international benchmark for measuring national commitment to food security. Its Zero Hunger programme, launched in 2003, made eradicating hunger and fighting poverty

key objectives on the domestic agenda. The government adopted a national food security and nutrition policy that recognizes the inalienable right of all citizens to sufficient, good quality food, and implemented it with a combination of emergency measures and programmes to redistribute income, boost food production and create employment. Within six years, initiatives such as the *Bolsa Família* cash transfer scheme for low-income families, free meals in every public school, and support to small-scale family farming had reduced the number of people facing food insecurity from 50 million to 30 million. Numbers fell most sharply in the country's urban areas, from 24.5 million to 14.8 million. Many of the programmes implemented under Zero Hunger were pioneered in the 1990s in the Brazilian city of Belo Horizonte. Over the past two decades, the city government has crafted a highly acclaimed system of food and nutrition security that serves 200 000 subsidized meals per day, markets 45 000 tonnes of fruit and vegetables a year, and actively encourages urban and peri-urban agriculture.

Belo Horizonte is the capital of Minas Gerais state and Brazil's sixth largest city, with a population of 2.5 million. While the city itself is 100 percent urban, it forms the core of the Belo Horizonte Metropolitan Region, which comprises urban and rural areas with a total population of more than 5.7 million, making it Brazil's third most populous urban agglomeration after São Paulo and Rio de Janeiro.

Like other Brazilian cities, Belo Horizonte suffered high rates of poverty and hunger in the early 1990s. It was estimated that 38 percent of families in the metropolitan region lived below the poverty line and 18 percent of children aged less than three years were malnourished. Infant mortality was a high 35.3 per thousand live births.

In 1992, Belo Horizonte elected a new mayor whose programme promoted inclusive social and economic development, focusing on ending hunger and poverty, creating jobs and investing in education and health. Among his government's first acts was to create a municipal food supply agency, Smab, charged with preventing and reducing malnutrition among vulnerable groups, bringing food to parts of the city that were neglected by commercial outlets, and increasing food production.

With an initial annual budget of some US$18 million, Smab designed a series of interventions based on the principle that all citizens have the right to an adequate quantity and quality of food throughout their lives, and that it is the duty of government to guarantee that right. One of its earliest initiatives, which

IN BRIEF: BELO HORIZONTE

Belo Horizonte invests US$27 million a year in food security programmes that benefit more than 300 000 citizens daily. An integral part of its vision of inclusive social development is urban and peri-urban agriculture.

1 The produce market in José Verano da Silva Square, Barreiro, sells 20 basic items at a fixed price.

2 Lunchtime at the Municipal School in Pedreira Prado Lopes. Each year, the city provides healthy meals to 80 000 students.

3 Public restaurant No. 2, in Ceará St., Santa Efigênia, provides low-priced meals to the general public. Breakfast costs US$0.25.

4 Diners at *Restaurante popular* No. 1, located on do Contorno Avenue, in the city centre.

5 The city has eight sales points for organic fruit and vegetables, such as this one on Avenida Paulo Camilo Pena, Belvedere.

6 This community garden in Vila Pinho sells most of its produce to local schools for students' meals.

Photographs: Makiko Taguchi (1,2,4-6), SMASAN (3)

provided enriched flour through health clinics to pregnant and nursing women, and to mothers of young children in low-income communities, is credited with helping reduce the city's under-5 child mortality rate by 72 percent between 1993 and 2005.

Today, SMAB has grown into the Secretariat for Nutrition and Food Security (SMASAN), with a staff of 180, including 30 nutritionists, a budget of US$27.2 million a year, and programmes that benefit more than 300 000 citizens daily. Although its approach has evolved over the years – for example, big improvements in child nutrition led to discontinuation of the enriched flour distribution – its basic mandate remains that of ensuring food and nutrition security in Belo Horizonte, especially among low-income residents.

It does that through a comprehensive set of programmes aimed at providing access to food – including free food distributions and school meals, subsidized food sales and the regulation of prices in food markets *(see page 78)* – and increasing agricultural production in both surrounding rural areas and within the city itself.

Food production is recognized as a legitimate land use in Belo Horizonte and is promoted by the municipal government's Urban Agriculture Support Policy, which sees it as contributing to "the full development of the social functions of the city".

At last count, SMASAN's programme for urban and peri-urban agriculture, operational since 1998, had created 185 vegetable gardens and 48 orchards across Belo Horizonte. They include gardens in schools and early childhood centres, three fully commercial gardens, and non-

commercial gardens in health and social welfare centres, nursing homes, shelters and other public facilities (for example, inmates of the city's Gamelleira prison have a garden and donate what they grow to charity).

The staff of Smasan includes agronomists and agricultural engineers, who can call on support from the Minas Gerais state agricultural extension service. Together, they manage the supply of free or heavily subsidized inputs – such as seed, fruit tree seedlings, organic fertilizer and soil amendments – and supervise the installation of irrigation systems and greenhouses.

To qualify for assistance, at least 10 citizens must form a group and apply for the lease of a public area for their gardening project. The majority of farmers in community gardens have incomes that amount to less than two minimum wages, more than half are women, and the predominant age group is over 60. Gardening is usually a part-time activity, a way of saving on food purchases, and a source of relaxation.

The city's 48 community gardens average around 150 sq m and are used to grow leafy vegetables and herbs for home consumption. Cultivation practices are largely organic. Pesticide is prohibited, and soil is usually fertilized with manure and earthworm humus purchased from outside the city. Since treated wastewater is not available for irrigation, gardeners use the city's drinking water supply.

The three large commercial gardens are operated by 30 families and are located in the neighbourhoods of Barreiro, Macaúbas and Vila Pinho. They sell most of their organically grown produce to local schools for students' meals, to the public at on-site sales centres, through fruit and vegetable markets, and door-to-door. In 2013, families operating two of the community gardens earned US$4 800 from the sale of vegetables to schools. The profits enabled them to buy their own inputs and equipment, with only minimal support from the municipality.

One of the most effective tools for promoting urban agriculture in Belo Horizonte has been school gardens, which increased in number from 60 to 126 between 2008 and 2012. Children are invited to attend workshops on microgardening, and those joining the programme receive technical assistance from Smasan to set up their gardens. Gardens have been established in schools and kindergartens with a total of 96 000 pupils, who spend on average one hour a day caring for the plants. The gardens are used to grow cabbage, lettuce, aromatic plants and herbs, and serve as open-air centres for environmental and food education.

In the meantime, the secretariat's orchards programme, *Pró-Pomar*, distributes fruit tree seedlings (typically cherry, carambola, orange,

MAKIKO TAGUCHI

Belo Horizonte children in one of the city's 126 school gardens

MAKIKO TAGUCHI

In Afonso Arinos Square, one of the 30 sales points where farmers sell fruit, vegetables and root crops directly to consumers

lemon and tangerine) free of charge to schools, institutions and community groups, primarily in low-income *favelas* on sloping land, where trees are also needed to prevent soil erosion. Members of the community are selected to care for the trees and all citizens are invited to help themselves to the fruit. In 2011-2012, Smasan provided 1 300 tree seedlings for planting in schools and community areas. It is estimated that 30 000 people consume fruit grown in *Pró-Pomar* orchards.

Low-income urban and peri-urban residents also benefit from a programme for growing food and medicinal plants in areas without enough space for a full garden. On request, Smasan provides self-organized community groups with training in microgardening, as well as compost and seeds. Participants are expected to supply the garden containers, such as wooden crates and discarded tyres, and plastic bottles for drip irrigation. In 2012, more than 90 four-hour training workshops were conducted, with the participation of 1 100 people.

Support to urban agriculture in Belo Horizonte is not limited to Smasan programmes. Another source is the city's five "centres for agro-ecological living", set up since 1993 by the municipal parks administration. Located mainly in peri-urban areas, the centres are managed by local residents and provide courses in organic gardening, waste recycling, nutrition and ecology. They have helped 98 families establish their own gardens. The centres also maintain nurseries – called "living pharmacies" – for the production and distribution of medicinal plants.

The municipal government also provides support and incentives to family agriculture in the metropolitan region's rural areas. Public procurement of food from smallholder family farmers for Belo Horizonte's school meals programme and public restaurants is not only encouraged but now mandatory under federal law. Smasan also manages a programme called *Direto da Roça* ("Straight from the field"), which provides 30 sales points within the city where small-scale farmers can sell leafy vegetables, fruit and root crops directly to consumers. Licences are obtained through public bidding. By agreement with Smasan, prices are fixed at an "affordable" level, which means savings for customers and higher volume sales for producers.

Farmers sell either their own produce or that of a cooperative. The quality of produce is controlled through laboratory tests and on-farm visits by Smasan staff, who also advise farmers on good agricultural practices and organic production. In 2012, one cooperative and 25 individual farmers sold through the

*Gardens have been established in **schools** **and kindergartens** with a total of 96 000 pupils*

programme more than 700 tonnes of fruit and vegetables, worth an estimated US$870 000.

Belo Horizonte's food and nutrition security system handles some 45 000 tonnes of food consumed in the city each year. Although the contribution of urban agriculture to that total is small – around 50 tonnes – the programme has had positive impacts. Vegetable consumption has increased among families and students directly involved in gardening, and an estimated 9 000 city residents have access to pesticide-free produce at a reasonable price.

Urban agriculture has strengthened social networks. The high level of community involvement in urban farming – through production groups and local councils – has been an important factor in the steady growth in total output and the area under gardens.

Broad stakeholder participation has been a feature of Belo Horizonte's approach to UPA development. SMASAN's programmes are guided by a Council for Food Security, representing municipal, state and federal governments, labour unions, food producers and distributors, consumer groups and other NGOs. Strategies and action plans for urban agriculture are developed by a civic forum, the Urban Agricultural Space, which brings together 33 civil society organizations and government agencies.

Among the forum's achievements was to persuade the municipality in 2010 to revise the city's land use plan to include urban agriculture as a non-residential land use, on a par with commerce, services and industry. That recognition establishes urban farming as an economic activity and urban farmers as a professional category.

Belo Horizonte's **alternative** food system

Belo Horizonte's Secretariat for Nutrition and Food Security manages 19 programmes aimed at ensuring its citizens' access to high quality and affordable food.

Food and nutrition assistance
In 2012, the school meals programme served 46 million meals to 80 000 students in schools, kindergartens and adult education centres. Since 2011, at least 30 percent of the food in meals is bought directly from family farms. SMASAN has 56 service points for preventing child malnutrition. In 2012, the city's food bank distributed 380 tonnes of food to social organizations for the preparation of communal meals for 366 000 people.

Subsidized food marketing
Belo Horizonte has four public restaurants and one cafeteria that provide low-priced meals to the general public. The majority of customers – 80 000 a month – are low-income or homeless. SMASAN nutritionists design the menus to provide 20 different meal choices. In 2012, some 3.3 million meals were served, at an average price discount of 60 percent.

Food supply and market regulation
The *Abastecer* ("Supply") programme allows licensed traders – currently numbering 33 – to sell fruit and vegetables in designated areas, on the condition that they offer at least 20 products at fixed, reduced prices. *Abastecer* licensees also help to increase access to fresh produce by selling fruit and vegetables at discounted prices from vans in the city's peripheral areas. In 2012, a total of 43 300 tonnes of food was supplied through *Abastecer*.

Nutrition education and careers in the food sector
SMASAN organizes classes in food and nutrition for the general public and for people working in its programmes. The city's Lagoinha food market serves as a training centre offering 40 different courses in food processing and preparation, including baking, confectionery making, and international cuisine.

MAKIKO TAGUCHI

At the Vila Pinho community garden, an urban farmer consults with an extensionist on solutions to pest problems

The forum also campaigned successfully for the approval, in September 2011, of the Municipal Urban Agriculture Support Policy, an important step forward as, until then, SMASAN agriculture programmes were regulated by municipal ordinances. The policy provides a firm foundation for further development of urban agriculture. The municipal government increased funding for SMASAN's programmes for urban, peri-urban and rural food production from US$160 000 in 2012 to $240 000 in 2013, and is integrating agriculture into municipal programmes for housing, welfare, health, education, employment, training and environmental protection.

It has also decided to establish, in the centre of Belo Horizonte, a weekly "urban agriculture fair" for the direct marketing of fruit, vegetables, cereals and flowers by urban growers and by rural farmers who have converted to organic production. By offering a major new sales outlet, the fair is expected to encourage the expansion of commercial gardening and, SMASAN hopes, attract more young people to urban agriculture.

Currently, there are no urban farmers in Belo Horizonte under the age of 30, and making food production an economically profitable activity is seen by SMASAN as one of the key challenges facing UPA development. Nearly all community gardens are subsidized by the municipal government and, without that support, most urban producers could not compete with vegetable growers in rural areas. Urban land and production inputs – such as town water and compost bought from outside the city – are expensive, and the city's services sector offers better paid and less physically demanding jobs.

While SMASAN's immediate priorities include further investment in training for urban food producers, in the longer term it plans to reduce production costs by improving wastewater treatment, introducing rainwater harvesting systems, and working with the city's waste management service to improve the quality of compost.

Another measure on the SMASAN agenda is to guarantee urban farmers' use of public land for at least five years. It is also lobbying for the zoning of parcels of urban land specifically for agriculture, which would relieve intense competition for land for real estate development. With lower production costs and security of tenure, Belo Horizonte's farmers could take advantage of their close proximity to urban consumers and the premium prices paid for locally grown, organic food that has health, social and environmental benefits.

An estimated 9 000 city residents have access to ***pesticide-free produce*** *at a reasonable price*

ROSARIO

Spring visitors to the Argentinian city of Rosario, on the Paraná River, 300 km north of Buenos Aires, should not miss the week-long "Rosario grows roots" festival. Last year's festival included guided tours of vegetable gardens along the city's main railway line, workshops on organoponic gardening, and open-air cooking classes at a 46 ha garden park. It ended with a Sunday fair in the riverside Plaza Suecia, where members of the Rosario Gardeners' Network displayed their organically grown vegetables and medicinal plants, along with the technologies they use for vertical gardening, solar drying of produce and anaerobic waste recycling. Celebrated annually since 2004, "Rosario grows roots" is a showcase of urban agriculture in a city which is, itself, internationally recognized as an example of how agriculture can be integrated successfully into urban development. With a strategy of recovering and transforming the city's underutilized resources, the city government's urban agriculture programme has helped to reclaim brownfields for food production and recreation, create permanent employment in agriculture for low-income residents, and boost the city's supply of chemical-free fresh food.

LEANDRO KIBISZ

With 1.35 million inhabitants, the Rosario metropolitan area is Argentina's third largest urban agglomeration and one of its most prosperous. Linked to the rich farmland of Santa Fe Province by road and river, its ports handle most of Argentina's exports of wheat, soybeans and vegetable oil. Exports of soybeans in 2013 reached 50 million tonnes, worth US$17.5 billion.

Just 13 years ago, Rosario was a rusting industrial city in a nation whose economy had collapsed. Many of the city's steel, chemical and paper factories had closed, and one-third of the workforce was unemployed. By December 2001, around 60 percent of the population had incomes below the poverty line, 30 percent were living in extreme poverty, and hyperinflation had increased the price of staple foods four times over. Desperation in Rosario's slums led to the looting of supermarkets by hungry people in search of food.

In February 2002, the municipal government responded to the crisis by launching an urban agriculture programme in collaboration with two key partners. One was the national *Pro-Huerta* ("Pro-Garden") programme, established in 1990 to foster small-scale, self-production of fresh food, mainly in low-income urban and peri-urban areas. The other was a Rosario NGO, the Centre for Agro-ecological Production Studies (Cepar), which had promoted vegetable gardening in the city's slums since 1987.

The initial plan – to provide 20 gardening groups with tools and seeds, and then gradually extend the programme throughout the city – was soon overwhelmed by requests for assistance. Funding for equipment, inputs and training workshops was increased, and within two years, some 800 community gardens were producing vegetables for an estimated 40 000 people.

The programme's immediate objective was to meet the emergency needs of unemployed slum-dwellers. But it also had a very clear vision of establishing urban agriculture as a permanent activity in the city. Given that an essential prerequisite was the long-term availability of suitable land, several local government departments collaborated with the National University of Rosario in a survey which found that 36 percent of the municipal area was vacant space.

Areas that could not be built on and were, therefore, suitable for farming included land along railways and highways, low-lying, peri-urban land subject to flooding, and designated greenbelts that had not been realized owing to lack of funding.

To provide gardeners with security of tenure, the city mayor approved in September 2004 an ordinance that established a rapid process for formalizing grants of vacant urban land to residents for agriculture. The Secretariat of Municipal Planning then worked with international partners to draft proposals for integrating agriculture into Rosario's urban development plan.

Meanwhile, the programme was implementing another key part of its long-term strategy: establishing a system for the direct marketing of gardeners' produce. Within six months of the start of the programme, the first urban farmers' market was in operation, and two more had been opened by 2004.

The first phase of the urban agriculture programme was so successful that, in 2004, Rosario was awarded the Un-Habitat International Award for Best Practices in urban development. An evaluation found that some 10 000 low-income families were directly

IN BRIEF: ROSARIO

Rosario has incorporated agriculture fully into its land use planning and urban development strategies. It is building a "green circuit" of family, community and commercial gardens, and multifunctional garden parks.

1 Last year's celebration of urban agriculture ended with a Sunday fair in Plaza Suecia, beside the Paraná River.

2 Some 70 families work in this garden park, established in the Bosque de los Constituyentes, Rosario's 260 ha nature reserve.

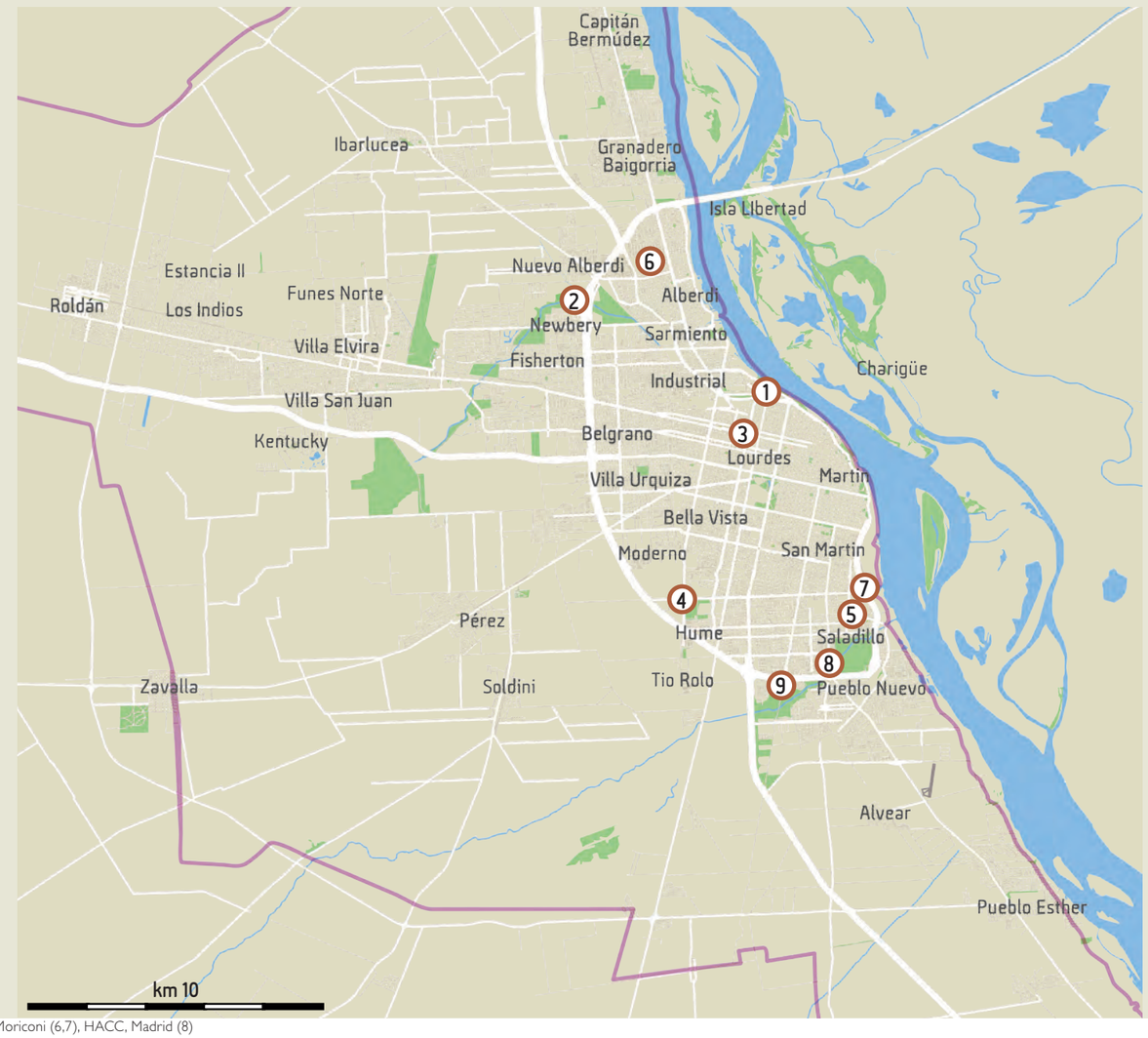
3 The seeds of more than 600 local and native plant varieties are conserved at the Ñanderoga Seed Bank for sowing in the city's gardens.

4 This *parque-huerta*, Hogar España, is found on land belonging to a senior citizens' centre on the edge of Rosario.

5 The city's agro-ecological nursery, in Saladillo, is a prime source of seedlings, compost and liquid fertilizers.

6 Gardens along the railway line through the city's northern district produce vegetables, ornamentals and aromatic plants.

7 Urban farm families in La Tablada garden park, established on 3 ha of riverside land granted by the National Roads Authority.



8 One of Rosario's first garden parks, Molino Blanco, reclaimed from 5 ha of flood-prone land on the city's southern boundary.

9 Found in a *barrio* with the same name, the Miraflores *parque-huerta* was established with funding from the Santa Fe provincial government.

Photographs: Javier Couretot (1,5,9), Sergio Goya (2), Victoria Benedetto (3), Marie Monique Robin (4), Silvio Moriconi (6,7), HACC, Madrid (8)

involved in gardening, and that producers were earning from sales up to US$150 a month, well above the poverty line. Two-thirds of gardeners were women and, for the vast majority of them, agriculture was the main source of income.

Since that year, urban agriculture in Rosario has evolved along with Argentina's economic recovery, and the re-emergence of the city as a centre of industry, commerce and services. Today, the number of city residents practising horticulture is around 1 800, of which 250 are full-time commercial producers organized in the Rosario Gardeners' Network.

The past decade has been a phase of consolidation for the urban agriculture programme. The focus has been on securing land and infrastructure for permanent cultivation on a larger scale, shortening marketing chains, establishing agro-industries and farmers' markets, increasing the supply and quality of organically grown produce, and promoting horticulture as an integral part of efforts to rehabilitate brownfields, create greenbelts and improve the quality of life in disadvantaged neighbourhoods.

Underpinning the entire programme is a solid political and institutional commitment, from national to local level. The city's commercial gardeners have been enrolled in the National Registry of Family Farmers, which entitles them to development assistance, social benefits and old-age pensions. *Pro-Huerta* continues to provide training, seed and tools, and the Santa Fe provincial government funds the installation of infrastructure as part of its support for family and community gardening in urban and peri-urban areas.

Soybean advances on city's "vegetable belt"

In 1996, Argentina approved the cultivation of genetically modified soybeans. Since then, the country's annual soybean production has quadrupled, from 12.4 million to more than 50 million tonnes, while the harvested area has grown from 6 million ha to 20 million ha.

Argentina is now the world's third largest producer of soybeans, and is the leading exporter of soybean meal and soybean oil. Most of Argentina's soybeans are grown in Santa Fe Province, and are processed in the Rosario municipal area for export.

Soybean production has displaced other traditional export crops, such as wheat and sunflower, as well as the production of milk, fruit and vegetables for the domestic market. In Rosario Department, around 70 000 ha of land were sown with soybeans in 2013,

PEDRO REYNA

compared to just 3 600 ha under vegetables and legumes. Horticulture around the city of Rosario is under increasing pressure as farmers lease their land for soybean production, which is more profitable and more easily managed, and has lower labour costs. The city's "vegetable belt" is also threatened by urban expansion.

To reduce the city's growing dependence on produce grown in other regions of the country, Rosario's Metropolitan Strategic Plan includes support to small-scale horticulture in semi-rural areas. The aim is to promote the adoption of good production practices and, by creating small producers' associations, to improve growers' access to the city's markets.

MARIE MONIQUE ROBIN

Late afternoon at La Tablada garden park. Plots are assigned annually, free of charge, to gardeners provided they use agro-ecological production practices

The promotion of urban agriculture is a policy of the Rosario city government, implemented by its Secretariat of Social Development in cooperation with *Pro-Huerta* and CEPAR, and aimed at "integrating men and women into social enterprises for the production and processing of food for family, community and market consumption".

The urban agriculture programme has an annual budget of some US$380 000 and is staffed by 25 agronomists and gardening promoters. Its activities are supported by a wide range of local, national and international public and private institutions, including RUAF, the municipality's services for public housing and parks and gardens, the Faculties of Engineering, Architecture and Agricultural Sciences at the University of Rosario, and the public/private sector Rosario Foundation.

Rosario is one of the few large South American cities that have incorporated agriculture fully into their land use planning and urban development strategies. Its Land Use Plan 2007-2017 makes specific provision for the agricultural use of public land in the spatial organization of the city and its territory. Under its Metropolitan Strategic Plan 2008-2018, Rosario is building a "green

*Rosario's Land Use Plan makes specific provision for the **agricultural use** of public land*

circuit", passing through and around the city, consisting of family and community gardens, large-scale, commercial vegetable gardens and orchards, multifunctional garden parks, and "productive *barrios*", where agriculture is integrated into programmes for the construction of public housing and the upgrading of slums.

In 2014, the green circuit consisted of more than 30 ha of land used to grow vegetables, fruit and medicinal and aromatic plants. The cultivated area includes a green corridor along the railway line through the city's northern district. Four fenced plots, which total 2 ha, are equipped with irrigation systems and greenhouses and used by residents and schoolchildren from the surrounding area to grow vegetables, ornamentals and aromatic plants.

Group productive gardens are used for the intensive production of seasonal vegetables and a wide range of aromatic plants, such as citronella, sage and rosemary. The gardens, which average 2 ha in size, are divided into plots of from 500 to 1 000 sq m, each cultivated by a gardener or a family. Each productive garden provides employment for around 20 people, and includes a seedling nursery, irrigation infrastructure and a training area.

Flowers, vegetables, herbs and medicinal plants are grown in smaller plots called *huertas-jardines*, which maintain plants, shrubs and trees that have been adapted to Rosario's climatic and growing conditions, and provide seeds and cuttings for the city's gardening community. In collaboration with *Pro-Huerta* and the Gardeners' Network, the urban agriculture programme has also created training areas, called *eco-huertas*, where citizens can learn the basics of organic food production at home.

But the centrepiece of Rosario's green circuit is the city's innovative garden parks – five large, landscaped green areas covering a total of 72 ha of land, which are used for agriculture and for cultural, sports and educational activities. Horticulture is practised on 24 ha of the total area, divided into plots averaging 900 sq m, for use by some 280 commercial gardeners, and smaller plots where 400 residents grow vegetables for home consumption.

One of the city's first *parques-huerta* was inaugurated in 2008 on flood-prone fields in Molino Blanco Sur, a neighbourhood of 800 families on the city's southern boundary. The park incorporated 5.6 ha of existing vegetable gardens and included, along one of its sides, a demonstration area which provides space for small-scale horticulture in front yards, organoponic microgardening, and protected woodlands.

Other garden parks are situated on 3 ha of riverside land granted by the National Roads Authority in the Saladillo Sur neighbourhood; inside the 260 ha Bosque de Los Constituyentes nature reserve; along the Rosario-Buenos Aires highway in the low-income Miraflores *barrio*; and on 3 ha of land belonging to a senior citizens' centre, Hogar Español, on the edge of farmland southwest of the city.

Plots are assigned annually, free of charge, to gardeners in return for a guarantee that they will grow crops continuously throughout the year, using agro-ecological production practices. The majority of gardeners come from nearby low-income neighbourhoods. They include ex-factory workers and fisherfolk, and many internal migrants from rural areas, who have contributed positively to the programme thanks to their knowledge of farming and intensive crop production.

Agricultural activities in the city are supported by an agro-ecological nursery, which raises seedlings and produces compost and liquid fertilizers, and the Ñanderoga Seed Bank, which conserves the seeds of more than 600 local and native plant varieties that are adapted to Rosario's growing conditions.

An open-air cooking class, using fresh organic vegetables, at the Molino Blanco garden park

SILVIO MORICONI

Virtually all permanent agricultural areas in Rosario have been established in degraded areas that were once considered unsuitable for food production. Many sites had been used as garbage dumps, and soils were often contaminated with heavy metals. The programme has used a variety of agro-ecological techniques – including planting legumes and grasses and incorporating plant residues, wood chips, compost and manure – in order to improve soil fertility, structure and organic matter content.

Crop production on the restored land also follows closely the principles of agro-ecology, which promotes family-based agriculture that is socially just, economically viable and environmentally sustainable. Growers produce their own basic inputs, such as fertilizer and seed, and use no synthetic pesticide or fertilizer. They grow vegetables intensively in high-yielding organoponic beds of compost substrate, maintain soil productivity with vermicompost, green manure and mulching, and plant their crops in rotations, to prevent pest attacks and diseases.

As a result, the vegetables and aromatic plants grown in Rosario's gardens are 100 percent organic and chemical-free. In place of certification by private agencies, the city has developed a system of "social certification", with produce safety and quality being guaranteed by the municipality, the Gardeners' Network, *Pro-Huerta* and a network of 450 consumers, *Vida Verde* ("Green Life"), which was established in 2008 to promote fair trade in locally grown organic food.

Visual communication

To promote its brand, "Rosario Natural", the urban agriculture programme commissioned Rosario's School of Visual Communication to design publicity materials and packaging for garden produce. These are some of the proposed designs.

ISCV, ROSARIO

All production areas have facilities for washing vegetables prior to sale, and the garden parks are equipped with solar dryers designed by the University of Rosario's Faculty of Engineering. In addition, the urban agriculture programme has created three "social agro-industries" – small-scale processing units managed by community groups, which provide work for people excluded from the formal labour market, and add value to primary production. The units prepare vegetable trays and baskets, process produce into pie fillings, soups, jams and sweets, and make a range of natural cosmetics, such as soap, gel, lotions and shampoo, from garden herbs.

Produce is sold directly from gardening sites, in weekly baskets home-delivered to consumers, to city restaurants, and through weekly "agrochemical-free vegetable fairs" that have been established in public areas in all six of the city's districts. It is estimated that sales in 2013 amounted to 100 tonnes of vegetables and 5 tonnes of aromatic and medicinal plants.

Rosario has shown that, when there is political will and a clear policy of social inclusion, it is possible to build, in a very short time, a successful programme for urban agriculture. In just 12 years, the programme has transformed and made productive use of the city's resources by rehabilitating wastelands, recovering and revitalizing public spaces, and creating an alternative, sustainable supply of nutritious, chemical-free food.

It has also brought important benefits to the city's low-income residents, allowing many of them to become engaged in civic construction and local development. The garden has provided an occupation and a space for learning and

IPES/RUAF

JAVIER COURETOT

Above: A community garden in one of Rosario's peri-urban barrios Right: Visitors browse the city's agro-ecological nursery

sharing experiences; for many women, it has brought economic independence and enhanced social relations. There is widespread public appreciation of urban farmers as guardians of the land, whose work improves the living environment and contributes to the food and nutrition security of all citizens.

Gardeners are officially recognized as entrepreneurs in Rosario's solidarity economy, which allows them to apply for municipal funding for their own investment projects. In 2013, twenty of them were certified as professional "organic gardening specialists" by the Ministry of Labour, Employment and Social Security.

The Rosario Gardeners' Network recently launched a project, funded by the Ministry of Labour, to share the benefits of urban agriculture with the most disadvantaged group in Rosario: the city's unemployed youth. The network has assigned plots to 140 young people, aged between 20 and 29 years, and is training them in agro-ecological production methods. The objective is to qualify the young gardeners as organic gardening specialists, which will allow them to join the formal labour market and meet the growing demand for their services in the public and private sectors.

*Gardeners are **officially recognized** as entrepreneurs in Rosario's solidarity economy*

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