

Urban agriculture

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Urban agriculture, **urban farming** or **urban gardening** is the practice of cultivating, processing, and distributing food in or around a village, town, or city.^[1] Urban agriculture can also involve animal husbandry, aquaculture, agroforestry, urban beekeeping, and horticulture. These activities occur in peri-urban areas as well, and peri-urban agriculture may have different characteristics.^[2]

Urban agriculture can reflect varying levels of economic and social development. In the global north, it often takes the form of a social movement for sustainable communities, where organic growers, ‘foodies,’ and ‘locavores’ form social networks founded on a shared ethos of nature and community holism.

These networks can evolve when receiving formal institutional support, becoming integrated into local town planning as a ‘transition town’ movement for sustainable urban development. In the developing south, food security, nutrition, and income generation are key motivations for the practice. In either case, more direct access to fresh vegetables, fruits, and meat products through urban agriculture can improve food security and food safety.



An urban farm in Chicago

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History



Huerto (vegetable garden or orchard) Romita, organization dedicated to urban agriculture located in the La Romita section of Colonia Roma, Mexico City

Community wastes were used in ancient Egypt to feed urban farming.^[3] In Machu Picchu, water was conserved and reused as part of the stepped architecture of the city, and vegetable beds were designed to gather sun in order to prolong the growing season.^[3] Allotment gardens came up in Germany in the early 19th century as a response to poverty and food insecurity.^[4] Victory gardens sprouted during WWI and WWII and were fruit, vegetable, and herb gardens in US, Canada, and UK. This effort was undertaken by citizens to reduce pressure on food production that was to support the war effort. Community gardening in most communities are open to the public and provide space for citizens to cultivate plants for food or recreation. A community gardening program that is well-established is Seattle's P-Patch. The grass roots permaculture movement has been hugely influential in the renaissance of urban agriculture throughout the world. The Severn Project in Bristol was started in 2010 for £2500 and provides 34 tons of produce per year, employing people from disadvantaged backgrounds.^[5]

The idea of supplemental food production beyond rural farming operations and distant imports is not new and has been used during war times and the Great Depression when food shortage issues arose. As early as 1893, citizens of a depression-struck Detroit were asked to use any vacant lots to grow vegetables. They were nicknamed Pingree's Potato Patches after the mayor, Hazen S. Pingree, who came up with the idea. He intended for these gardens to produce income, food supply, and even boost independence during times of hardship.^[6]

During the first World War, president Woodrow Wilson called upon all American citizens to utilize any available open space for food growth, seeing this as a way to pull them out of a potentially damaging situation. Because most of Europe was consumed with war, they were unable to produce sufficient food supplies to be shipped to the U.S., and a new plan was implemented with the intent to feed the U.S. and even

supply a surplus to other countries in need. By the year 1919, over 5 million plots were growing food and over 500 million pounds of produce was harvested. A very similar practice came into use during the Great Depression that provided a purpose, a job, and food to those who would otherwise be without anything during such harsh times. In this case, these efforts helped to raise spirits socially as well as to boost economic growth. Over 2.8 million dollars worth of food was produced from the subsistence gardens during the Depression. By the time of the Second World War, the War/Food Administration set up a National Victory Garden Program that set out to systematically establish functioning agriculture within cities. With this new plan in action, as many as 5.5 million Americans took part in the victory garden movement and over 9 million pounds of fruit and vegetables were grown a year, accounting for 44% of U.S.-grown produce throughout that time.

In 2010, New York City saw the building and opening of the world's largest privately owned and operated rooftop farm, followed by an even larger location in 2012.^[7] Both were a result of municipal programs such as The Green Roof Tax Abatement Program^[8] and Green Infrastructure Grant Program.^[9]

With its past success in mind and with modern technology, urban agriculture today can be something to help both developed and developing nations.

Perspectives

Resource and economic

The Urban Agriculture Network has defined urban agriculture as:^[10]

[A]n industry that produces, processes, and markets food, fuel, and other outputs, largely in response to the daily demand of consumers within a town, city, or metropolis, on many types of privately and publicly held land and water bodies found throughout intra-urban and peri-urban areas. Typically urban agriculture applies intensive production methods, frequently using and reusing natural resources and urban wastes, to yield a diverse array of land-, water-, and air-based fauna and flora, contributing to the food security, health, livelihood, and environment of the individual, household, and community.

Environmental

The Council on Agriculture, Science and Technology (CAST) defines urban agriculture to include aspects of environmental health, remediation, and recreation.^[11]



A tidy front yard flower and vegetable garden in Aretxabaleta, Spain



A vegetable garden in the square in front of the train station in Ezhou, China

Urban agriculture is a complex system encompassing a spectrum of interests, from a traditional core of activities associated with the production, processing, marketing, distribution, and consumption, to a multiplicity of other benefits and services that are less widely acknowledged and documented. These include recreation and leisure; economic vitality and business entrepreneurship, individual health and well-being; community health and well being; landscape beautification; and environmental restoration and remediation.

Modern planning and design initiatives^[12] are often more responsive to this model of urban agriculture because it fits within the current scope of sustainable design. The definition allows for a multitude of interpretations across cultures and time. Frequently it is tied to policy decisions to build sustainable cities.^[13]

Food security

Access to nutritious food, both economically and geographically, is another perspective in the effort to locate food and livestock production in cities. With the tremendous influx of world population to urban areas, the need for fresh and safe food is increased. The Community Food Security Coalition (CFSC) defines food security as:

All persons in a community having access to culturally acceptable, nutritionally adequate food through local, non-emergency sources at all times.

Areas faced with food security issues have limited choices, often relying on highly processed fast food or convenience store foods that are high in calories and low in nutrients, which may lead to elevated rates of diet-related illnesses such as diabetes. These problems have brought about the concept of food justice which Alkon and Norgaard (2009; 289) explain is, "places access to healthy, affordable, culturally appropriate food in the contexts of institutional racism, racial formation, and racialized geographies.... Food justice serves as a theoretical and political bridge between scholarship and activism on sustainable agriculture, food insecurity, and environmental justice."^[14]

Impact

Economic

Urban and peri-urban agriculture (UPA) expands the economic base of the city through production, processing, packaging, and marketing of consumable products. This results in an increase in entrepreneurial activities and the creation of jobs, as well as reducing food costs and improving quality.^[15] UPA provides employment, income, and access to food for urban populations, which helps to relieve chronic and emergency food insecurity. Chronic food insecurity refers to less affordable food and growing urban poverty, while emergency food insecurity relates to breakdowns in the chain of food distribution. UPA plays an important role in making food more affordable and in providing emergency supplies of food.^[16] Research into market values for produce grown in urban gardens has attributed to a community garden plot a median yield value of between approximately \$200 and \$500 (US, adjusted for inflation).^[17]

Social

There are many social benefits that have emerged from urban agricultural practices, such as improved overall social and emotional well-being, improved health and nutrition, increased income, employment, food security within the household, and community social life. Urban agriculture can have a large impact on the social and emotional well-being of individuals. Individuals report to have decreased levels of stress and better overall mental health when they have opportunities to interact with nature through a garden. Urban gardens are thought to be relaxing and calming, and offer a space of retreat in densely populated urban areas.^[18]

UA can have an overall positive impact on community health, which directly impacts individuals social and emotional well-being. There have been many documented cases in which community gardens lead to improved social relationships, increased community pride, and overall community improvement and mobilization. This improvement in overall community health can also be connected to decreased levels of crime and suicide rates.^[18]

Urban gardens are often places that facilitate positive social interaction, which also contributes to overall social and emotional well-being. Many gardens facilitate the improvement of social networks within the communities that they are located. For many neighborhoods, gardens provide a “symbolic focus,” which leads to increased neighborhood pride.^[19]

When individuals come together around UA, physical activity levels are often increased. Everything that is involved in starting and maintaining a garden, from turning the soil to digging holes, contributes to an individual’s physical activity. Many state that working in agriculture is much more interesting and fulfilling than going to the gym, and that it makes getting exercise “fun.” In addition to the exercise that individuals receive while actually working in gardens, many people say that the majority of the exercise they receive through urban agriculture is actually getting to the gardens—many people either walk or ride their bike to the sites, which provides many physical benefits.^[20]

UPA can be seen as a means of improving the livelihood of people living in and around cities. Taking part in such practices is seen mostly as informal activity, but in many cities where inadequate, unreliable, and irregular access to food is a recurring problem, urban agriculture has been a positive response to tackling food concerns. Due to the food security that comes with UA, a feelings of independence and empowerment often arise. The ability to produce and grow food for oneself has also been reported to improve levels of self-esteem or of self-efficacy.^[18] Households and small communities take advantage of vacant land and contribute not only to their household food needs but also the needs of their resident city.^[21] The CFSC states that:



A sprouting glass jar with mung beans in it.



The needs of urban landscaping can be combined with those of suburban livestock farmers. (Kstovo, Russia)

Community and residential gardening, as well as small-scale farming, save household food dollars. They promote nutrition and free cash for non-garden foods and other items. As an example you can raise your own chickens on an urban farm and have fresh eggs for only \$0.44 per dozen.^[22]

This allows families to generate larger incomes selling to local grocers or to local outdoor markets, while supplying their household with proper nutrition of fresh and nutritional produce.

Some community urban farms can be quite efficient and help women find work, who in some cases are marginalized from finding employment in the formal economy.^[23] Studies have shown that participation from women have a higher production rate, therefore producing the adequate amount for household consumption while supplying more for market sale.^[24]

As most UA activities are conducted on vacant municipal land, there have been rising concerns about the allocation of land and property rights. The IDRC and the FAO have published the Guidelines for Municipal Policymaking on Urban Agriculture, and are working with municipal governments to create successful policy measures that can be incorporated in urban planning.^[25]

Energy efficiency

The current industrial agriculture system is accountable for high energy costs for the transportation of foodstuffs. According to a study by Rich Pirog, the associate director of the Leopold Center for Sustainable Agriculture at Iowa State University, the average conventional produce item travels 1,500 miles (2,400 km),^[26] using, if shipped by tractor-trailer, 1 US gallon (3.8 l; 0.83 imp gal) of fossil fuel per 100 pounds (45 kg).^[27] The energy used to transport food is decreased when urban agriculture can provide cities with locally grown food. Pirog found that traditional, non-local, food distribution system used 4 to 17 times more fuel and emitted 5 to 17 times more CO₂ than the local and regional transport.^[28]

Similarly, in a study by Marc Xuereb and Region of Waterloo Public Health, they estimated that switching to locally grown food could save transport-related emissions equivalent to nearly 50,000 metric tons of CO₂, or the equivalent of taking 16,191 cars off the road.^[29]



Edible Oyster Mushrooms growing on used coffee grounds

Carbon footprint

As mentioned above, the energy-efficient nature of urban agriculture can reduce each city's carbon footprint by reducing the amount of transport that occurs to deliver goods to the consumer.^[30]

Also these areas can act as carbon sinks^[31] offsetting some of carbon accumulation that is innate to urban areas, where pavement and buildings outnumber plants. Plants absorb atmospheric carbon dioxide (CO₂) and release breathable oxygen (O₂) through photosynthesis. The process of Carbon Sequestration can be further improved by combining other agriculture techniques to increase removal from the atmosphere and prevent

release of CO₂ during harvest time. However, this process relies heavily on the types of plants selected and the methodology of farming.^[29] Specifically, choosing plants that do not lose their leaves and remain green all year can increase the farms ability to sequester carbon.^[29]

Reduction in ozone and particulate matter

The reduction in ozone and other particulate matter can benefit human health.^[32] Reducing these particulates and ozone gases could reduce mortality rates in urban areas along with increase the health of those living in cities. Just to give one example, in the article “Green roofs as a means of pollution abatement,” the author argues that a rooftop containing 2000 m² of uncut grass has the potential to remove up to 4000 kg of particulate matter. According to the article, only one square meter of green roof is needed to offset the annual particulate matter emissions of a car.^{[33][34]}

Soil decontamination

Vacant urban lots are often victim to illegal dumping of hazardous chemicals and other wastes. They are also liable to accumulate standing water and “grey water”, which can be dangerous to public health, especially left stagnant for long periods. The implementation of urban agriculture in these vacant lots can be a cost-effective method for removing these chemicals. In the process known as Phytoremediation, plants and the associated microorganisms are selected for their chemical ability to degrade, absorb, convert to an inert form, and remove toxins from the soil.^[35] Several chemicals can be targeted for removal including heavy metals (e.g. Mercury and lead) inorganic compounds (e.g. Arsenic and Uranium), and organic compounds (e.g. petroleum and chlorinated compounds like PBC’s).^[36]

Phytoremediation is both an environmentally friendly, cost-effective, and energy-efficient measure to reduce pollution. Phytoremediation only costs about \$5–\$40 per ton of soil being decontaminated.^{[37][38]} Implementation of this process also reduces the amount of soil that must be disposed of in a hazardous waste landfill.^[39]

Urban agriculture as a method to mediate chemical pollution can be effective in preventing the spread of these chemicals into the surrounding environment. Other methods of remediation often disturb the soil and force the chemicals contained within it into the air or water. Plants can be used as a method to remove chemicals and also to hold the soil and prevent erosion of contaminated soil decreasing the spread of pollutants and the hazard presented by these lots.^{[39][40]}

Noise pollution

Large amounts of noise pollution not only lead to lower property values and high frustration, they can be damaging to human hearing and health.^[41] In the study “Noise exposure and public health,” they argue that exposure to continual noise is a public health problem. They cite examples of the detriment of continual noise on humans to include: “hearing impairment, hypertension and ischemic heart disease, annoyance, sleep



A windowfarm, incorporating discarded plastic bottles into pots for hydroponic agriculture in urban windows

disturbance, and decreased school performance.” Since most roofs or vacant lots consist of hard flat surfaces that reflect sound waves instead of absorb them, adding plants that can absorb these waves has the potential to lead to a vast reduction in noise pollution.^[41]

Nutrition and quality of food

Daily intake of a variety of fruits and vegetables is linked to a decreased risk of chronic diseases including diabetes, heart disease and cancer. Urban agriculture is associated with increased consumption of fruits and vegetables^[42] which decreases risk for disease and can be a cost-effective way to provide citizens with quality, fresh produce in urban settings.^[43]

People are more likely to try new vegetables when they take an active role in the planting and cultivation of an urban garden.^[42] Produce from urban gardens can be perceived to be more flavorful and desirable than store bought produce^[44] which may also lead to a wider acceptance and higher intake. A Flint, Michigan study found that those participating in community gardens consumed fruits and vegetables 1.4 more times per day and were 3.5 times more likely to consume fruits or vegetables at least 5 times daily (p. 1).^[42] Garden-based education can also yield nutritional benefits in children. An Idaho study reported a positive association between school gardens and increased intake of fruit, vegetables, vitamin A, vitamin C and fiber among sixth graders.^[45]

Urban gardening improves dietary knowledge.^[43] Inner city youth of Minneapolis/St. Paul, Minnesota who were part of a community garden intervention were better able to communicate specific nutritional benefits of fruits and vegetables on the body than those who had not participated in a community garden.^[46]

Community gardeners were also found to consume fewer sweet foods and drinks in a Philadelphia study.^[42]

The nutrient content of produce from an urban garden may be higher due to decrease in time between production and consumption. A 30-50% nutrient loss can happen in the 5–10 days it takes to travel from farm-to-table.^[43] Harvesting fruits and vegetables initiates the enzymatic process of nutrient degradation which is especially detrimental to water soluble vitamins such as ascorbic acid and thiamin.^[47] The process of blanching produce in order to freeze or can reduces nutrient content slightly but not nearly as much as the amount of time spent in storage.^[47] Harvesting produce from one’s own community garden cuts back on storage times significantly.

Urban agriculture also provides quality nutrition for low income households. Studies show that every \$1 invested in a community garden yields \$6 worth of vegetables, if labor is not considered a factor in investment.^[43] Many urban gardens reduce the strain on food banks and other emergency food providers by donating shares of their harvest and provide fresh produce in areas that otherwise might be food deserts. The supplemental nutrition program Women, Infants and Children (WIC) as well as the Supplemental Nutrition Assistance Program (SNAP) have partnered with several urban gardens nationwide to improve the accessibility to produce in exchange for a few hours of volunteer gardening work.^[48]

Economy of scale

Using high-density urban farming, as for instance with vertical farms or stacked greenhouses, many environmental benefits can be achieved on a city-wide scale that would be impossible otherwise. These systems do not only provide food, but also produce potable water from waste water, and can recycle organic waste back to energy and nutrients.^[49] At the same time, they can reduce food-related transportation to a minimum while providing fresh food for large communities in almost any climate.

Health inequalities and food justice

A 2009 report by the USDA, determined that "Evidence is both abundant and robust enough for us to conclude that Americans living in low-income and minority areas tend to have poor access to healthy food", and that the "structural inequalities" in these neighborhoods "contribute to inequalities in diet and diet-related outcomes".^[50] These diet related outcomes, including obesity and diabetes, have become epidemic in low-income urban environments in the United States.^[51] Although the definition and methods for determining "food deserts" have varied, studies indicate that, at least in the United States, there are racial disparities in the food environment.^[52] Thus using the definition of environment as the place where people live, work, play and pray, food disparities become an issue of environmental justice.^[53] This is especially true in American inner-cities where a history of racist practices have contributed to the development of food deserts in the low-income, minority areas of the urban core.^[54] The issue of inequality is so integral to the issues of food access and health that the Growing Food & Justice for All Initiative was founded with the mission of "dismantling racism" as an integral part of creating food security.^[55]

Not only can urban agriculture provide healthy, fresh food options, but also can contribute to a sense of community, aesthetic improvement, crime reduction, minority empowerment and autonomy, and even preserve culture through the use of farming methods and heirloom seeds preserved from areas of origin.^[56]

Environmental justice

Urban agriculture may advance environmental justice and food justice for communities living in food deserts.^[12] First, urban agriculture may reduce racial and class disparities in access to healthy food. When urban agriculture leads to locally grown fresh produce sold at affordable prices in food deserts, access to healthy food is not just available for those who live in wealthy areas, thereby leading to greater equity in rich and poor neighborhoods.^[57]

Improved access to food through urban agriculture can also help alleviate psychosocial stresses in poor communities. Community members engaged in urban agriculture improve local knowledge about healthy ways to fulfill dietary needs. Urban agriculture can also better the mental health of community members. Buying and selling quality products between local producers and consumers allows community members to support one another, which may reduce stress. Thus, urban agriculture can help improve conditions in poor communities, where residents experience higher levels of stress due to a perceived lack of control over the quality of their lives.^[58]

Urban agriculture may improve the livability and built environment in communities that lack supermarkets and other infrastructure due to the presence of high unemployment caused by deindustrialization. Urban farmers who follow sustainable agriculture methods can not only help to build local food system infrastructure, but can also contribute to improving local air, and water and soil quality.^[59] When agricultural products are produced locally within the community, they do not need to be transported, which reduces CO₂

emission rates and other pollutants that contribute to high rates of asthma in lower socioeconomic areas. Sustainable urban agriculture can also promote worker protection and consumer rights.^[59] For example, communities in New York City, Illinois, and Richmond, Virginia have demonstrated improvements to their local environments through urban agricultural practices.^[60]

However, urban agriculture can also present urban growers with health risks if the soil used for urban farming is contaminated. Although local produce is often believed to be clean and healthy, many urban farmers ranging from New York urban farmer Frank Meushke^[61] to Presidential First Lady Michelle Obama^[62] have found their produce contained high levels of lead, due to soil contamination, which is harmful to human health when consumed. The soil contaminated with high lead levels often originates from old house paint containing lead, vehicle exhaust, or atmospheric deposition. Without proper education on the risks of urban farming and safe practices, urban consumers of urban agricultural produce may face additional health related issues^[57]

Implementation



A small urban farm in Amsterdam

Creating a community-based infrastructure for urban agriculture means establishing local systems to grow and process food and transfer it from farmer (producer) to consumer.^[12]

To facilitate food production, cities have established community-based farming



Rooftop urban farming at the Food Roof Farm in downtown St. Louis, MO

projects. Some projects have collectively tended community farms on common land, much like that of eighteenth-century Boston Common. One such community farm is the Collingwood Children's Farm in Melbourne, Australia. Other community garden projects use the allotment garden model, in which gardeners care for individual plots in a larger gardening area, often sharing a tool shed and other amenities. Seattle's P-Patch gardens use this model, as did the South Central Farm in Los Angeles and the Food Roof Farm in St. Louis. Independent urban gardeners also grow food in individual yards and on roofs. Garden sharing projects seek to pair producers with land, typically, residential yard space. Roof gardens allow for urban dwellers to maintain green spaces in the city without having to set aside a tract of undeveloped land. Rooftop farms allow otherwise unused industrial roofspace to be used productively, creating work and profit.^[63] Projects around the world seek to enable cities to become 'continuous productive landscapes' by cultivating vacant urban land and temporary or permanent kitchen gardens.^[64]

Food processing on a community level has been accommodated by centralizing resources in community tool sheds and processing facilities for farmers to share. The Garden Resource Program Collaborative based in Detroit has cluster tool banks. Different areas of the city have toolbanks where resources like tools, compost, mulch, tomato stakes, seeds, and education can be shared and distributed with the gardeners in that cluster. Detroit's Garden Resource Program Collaborative also strengthens their gardening community by providing to their members transplants; education on gardening, policy, and food issues; and by building connectivity between gardeners through workgroups, potlucks, tours, field trips, and cluster workdays.

Farmers' markets, such as the farmers' market in Los Angeles, provide a common land where farmers can sell their product to consumers. Large cities tend to open their farmers markets on the weekends and one day in the middle of the week. For example, the farmers' market of Boulevard Richard-Lenoir in Paris, France, is open on Sundays and Thursdays. However, to create a consumer dependency on urban agriculture and to introduce local food production as a sustainable career for farmers, markets would have to be open regularly. For example, the Los Angeles Farmers' Market is open seven days a week and has linked several local grocers together to provide different food products. The market's central location in downtown Los Angeles provides the perfect interaction for a diverse group of sellers to access their consumers.



Tomato plants growing in a pot farming alongside a small house in New Jersey in fifteen garbage cans filled with soil, grew over 700 tomatoes during the summer of 2013.

Queensland, Australia

In Queensland many people have started a trend of urban farming both utilizing Aquaponics and self watering containers. One man by the name of Rob Bob created Rob's Bits out the Back, Urban farming channel on YouTube documenting his stories and helping others to utilize their urban setting for farming. He has his whole yard front and back made into a gardening paradise.^{[65][66][67]}

Cairo, Egypt

In Egypt, development of rooftop gardens began in the 1990s. In the early 1990s at Ain Shams University, a group of agriculture professors developed an initiative focused on growing organic vegetables to suit densely populated cities of Egypt. The initiative was applied on a small scale; until it was officially adopted in 2001, by the Food and Agriculture Organization (FAO).^[68]

Havana, Cuba

Due to the shortage of fuel during the crisis and therefore severe deficiencies in the transportation sector, a growing percentage of the agricultural production takes place in the so-called urban agriculture. In 2002, 35,000 acres (14,000 ha) of urban gardens produced 3,400,000 short tons (3,100,000 t) of food. In Havana, 90% of the city's fresh produce come from local urban farms and gardens. In 2003, more than 200,000 Cubans worked in the expanding urban agriculture sector.^[69]

Mumbai, India

Economic development in Mumbai brought a growth in population caused mainly by the migration of laborers from other regions of the country. The number of residents in the city increased more than twelve times in the last century. Greater Mumbai, formed by City Island and Salsette Island, is the largest city in India with a population of 16.4 million, according to data collected by the census of 2001. Mumbai is one of the densest cities in the world, 48,215 persons per km² and 16,082 per km² in suburban areas. In this scenario, urban agriculture seems unlikely to be put into practice since it must compete with real estate developers for the access and use of vacant lots. Alternative farming methods have emerged as a response to scarcity of land, water, and economic resources employed in UPA.

Dr. Doshi's city garden methods are revolutionary for being appropriate to apply in reduced spaces as terraces and balconies, even on civil construction walls, and for not requiring big investments in capital or long hours of work. His farming practice is purely organic and is mainly directed to domestic consumption. His gardening tools are composed of materials available in the local environment: sugarcane waste, polyethylene bags, tires, containers and cylinders, and soil. The containers and bags (open at both ends) are filled with the sugarcane stalks, compost, and garden soil, which make possible the use of minimal quantity of water if compared to open fields. Dr. Doshi states that solar energy can replace soil in cities. He also recommends the idea of chainplanting, or growing plants in intervals and in small quantities rather than at once and in large amounts. He has grown different types of fruit such as mangos, figs, guavas, bananas, and sugarcane stalks in his terrace of 1,200 sq ft (110 m²) in Bandra. The concept of city farming developed by Dr. Doshi consumes the entire household's organic waste. He subsequently makes the household self-sufficient in the provision of food: 5 kilograms (11 lb) of fruits and vegetables are produced daily for 300 days a year.^[70]

The main objectives of a pilot project at city farm at Rosary High School, Dockyard Road, were to promote economic support for street children, beautify the city landscape, supply locally produced organic food to urban dwellers (mainly those residing in slums), and to manage organic waste in a sustainable city. The project was conducted in the Rosary School, in Mumbai, with the participation of street children during 2004. A city farm was created in a terrace area of 400 sq ft (37 m²). The participants were trained in urban farming techniques. The farm produced vegetables, fruits, and flowers. The idea has spread the concept of city farm to other schools in the city.

The Mumbai Port Trust (MBPT) central kitchen distributes food to approximately 3,000 employees daily, generating important amounts of organic disposal. A terrace garden created by the staff recycles ninety percent of this waste in the production of vegetables and fruits. Preeti Patil, who is the catering officer at the MBPT explains the purpose of the enterprise:^[71]

Mumbai Port Trust has developed an organic farm on the terrace of its central kitchen, which is an area of approximately 3,000 sq ft (280 m²). The activity of city farming was started initially to dispose of kitchen organic waste in an ecofriendly way. Staff members, after their daily work in the kitchen, tend the garden, which has about 150 plants.

Bangkok, Thailand

In early 2000, urban gardens were started under the direction of the NGO, Thailand Environment Institute (TEI), to help achieve the Bangkok Metropolitan Administrations (BMA) priority to 'green' Thailand. With a population of 12 million and 39% of the land in the city vacant due to rapid expansion of the 1960s–80s Bangkok is a test bed for urban gardens centered on community involvement.^[13] The two urban gardens initiated by TEI are in Bangkok Noi and Bangkokapi and the main tasks were stated as:

- Teach members of the communities the benefits of urban green space.
- Create the social framework to plan, implement, and maintain the urban green space.
- Create a process of method to balance the needs of the community with the needs of the larger environmental concerns.

While the goals of the NGO are important in a global context, the community goals are being met through the work of forming the urban gardens themselves. In this sense, the creation, implementation, and maintenance of urban gardens is highly determined by the desires of the communities involved. However, the criteria by which TEI measured their success illustrates the scope of benefits to a community which practices urban agriculture. TEI's success indicators were:

- Establishing an Urban Green Plan
- Community Capacity Building
- Poverty Reduction
- Links with Government
- Developing a Model for Other Communities

Evan D.G. Fraser wrote in the article *Urban Ecology in Bangkok Thailand* that although the project was initiated to serve the environmental needs of the city it quickly illustrated the positive side effects of urban agriculture:

In many ways, the urban environment became a lens through which communities re-evaluated their own relationship with the city, the impact of urbanization in a global context, and how small groups can exert some control over the shape of their neighbourhoods.

China

Beijing's increase in land area from 4,822 square kilometres (1,862 sq mi) in 1956 to 16,808 square kilometres (6,490 sq mi) in 1958 led to the increased adoption of peri-urban agriculture. Such "suburban agriculture" led to more than 70% of non-staple food in Beijing, mainly consisting of vegetables and milk, to be produced by the city itself in the 1960s and 1970s. Recently, with relative food security in China, periurban agriculture has led to improvements in the quality of the food available, as opposed to quantity. One of the more recent experiments in urban agriculture is the Modern Agricultural Science Demonstration Park in Xiaotangshan.^[72]

Traditionally, Chinese cities have been known to mix agricultural activities within the urban setting. Shenzhen, once a small farming community, is now a fast-growing metropolis due to the Chinese government designation as an open economic zone. Due to large and growing population in China, the government supports urban self-sufficiency in food production. Shenzhen's village structure, sustainable methods, and new agricultural advancements initiated by the government have been strategically configured to supply food for this growing city.^[73]

The city farms are located about 10 kilometres (6.2 mi) from city center in a two-tier system. The first tier approached from city center produces perishable items. Located just outside these farms, hardier vegetables are grown such as potatoes, carrots, and onions. This system allows produce to be sold in city markets just a few short hours after picking.

Another impressive method used within Chinese agriculture and aquaculture practice is the mulberry-dyke fish-pond system, which is a response to waste recycling and soil fertility. This system can be described as:

^[73]

Mulberry trees are grown to feed silkworms and the silkworm waste is fed to the fish in ponds. The fish also feed on waste from other animals, such as pigs, poultry, and buffalo. The animals in turn are given crops that have been fertilized by mud from the ponds. This is a sophisticated system as a continuous cycle of water, waste and food...with man built into the picture.

As population grows and industry advances, the city tries to incorporate potential agricultural growth by experimenting in new agricultural methods. The Fong Lau Chee Experimental Farm in Dongguan, Guangdong has worked with new agricultural advancements in lychee production. This farm was established with aspirations of producing large quantities and high quality lychees, by constantly monitoring sugar content, and their seeds. This research, conducted by local agricultural universities allows for new methods to be used with hopes of reaching the needs of city consumers.^[74]

However, due to increased levels of economic growth and pollution, some urban farms have become threatened. The government has been trying to step in and create new technological advancements within the agricultural field to sustain levels of urban agriculture.

"The city plans to invest 8.82 billion yuan in 39 agricultural projects, including a safe agricultural base, an agricultural high-tech park, agricultural processing and distribution, forestry, eco-agricultural tourism, which will form an urban agriculture with typical Shenzhen characteristics" in conjunction with this program the city is expected to expand the Buji Farm Produce Wholesale Market.^[75]

According to the Municipal Bureau of Agriculture, Forestry and Fishery the city will invest 600 million yuan on farms located around the city, with hopes of the farms to provide "60 percent of the meat, vegetables and aquatic products in the Shenzhen market".^[76]

There has also been an emerging trend of going green and organic as a response to pollution and pesticides used in farming practices. Vegetable suppliers are required to pass certain inspections held by the city's Agriculture Bureau before they can be sold as "green".^[77]

New York

In New York City, many low-income residents suffer from high rates of obesity and diabetes, and limited sources of fresh produce. The City and local nonprofit groups have been providing land, training and financial encouragement, but the impetus in urban farming has really come from the farmers, who often volunteer when their regular work day is done. In addition, the New York City Department of Environmental Protection offers a grant program for private property owners in combined sewer areas of New York City. The minimum requirement is to manage 1” of storm water runoff from the contributing impervious area. Eligible projects include green roofs, rooftop farms, and rainwater harvesting on private property in combined sewer areas. Because of this grant program, New York City now has the world's largest rooftop farms.^[78]

Some urban gardeners have used empty lots to start community or urban gardens. However, the soil must be tested for heavy contamination in city soil because of vehicle exhaust and remnants of old construction. The City also has a composting program, which is available to gardeners and farmers. One group, GreenThumb, provides free seedlings. Another program, the City Farms project operated by the nonprofit Just Food, offers courses on growing and selling food.^[79]

Two alternate means of growing are rooftop gardens and hydroponic (soil-less) growing. *The New York Times* wrote an article about one of Manhattan's first gardens which incorporate both these techniques.^[80] Another option urban gardeners have used is Farm-in-A-Box LLC, a company that provides hand-made, ready-to-use garden boxes to residents and schools.^[81]

California

In response to the recession of 2008, a coalition of community-based organizations, farmers, and academic institutions in California's Pomona Valley formed the Pomona Valley Urban Agriculture Initiative.

After the passage of the North American Free Trade Agreement, cheap grain from the United States flooded Mexico, driving peasant farmers off of their land. Many immigrated into the Pomona Valley and found work in the construction industry. With the 2008 recession, the construction industry also suffered in the region. It is unlikely to regain its former strength because of severe water shortages in this desert region as well as ongoing weakness in the local economy. These immigrants were dry land organic farmers in their home country by default since they did not have access to pesticides and petroleum-based fertilizers. Now, they found themselves on the border of two counties: Los Angeles County with a population of 10 million and almost no farmland, and San Bernardino County which has the worst access to healthy food in the state.^[82] In both counties, there is a growing demand for locally grown organic produce. In response to these conditions, Uncommon Good, a community-based nonprofit organization that works with immigrant farmer families, convened a forum which became the Urban Farmers Association. The Urban Farmers Association is the first organization of its kind for poor immigrant farmers in the Pomona Valley. Its goal is to develop opportunities for its members to support themselves and their families through urban agriculture. With Uncommon Good, it is a founding member of the Pomona Valley Urban Agriculture Initiative (PVUAI). The PVUAI is working with local colleges and universities to expand upon a food assessment survey that was done in the City of Pomona.^[83]

Oakland

Urban agriculture in West Oakland has taken a radical form that can be traced back to community gardening initiatives starting in the 1970s in the cities of Berkeley and Oakland, and the city's African-American heritage.^[84] Oakland's manufacturing industry attracted new residents during WWII. To reduce racial tension, the Oakland Housing Authority established housing projects for blacks in West Oakland and whites in East Oakland. With exclusionary covenants and redlining by banks, development capital was kept out of West Oakland while the African-American population had limited opportunities to rent or buy housing outside West Oakland.^[85]

The Black Panther Party (BPP) played a role in seeding urban agricultural practices in West Oakland.^[84] One of its social programs aimed to improve the access to healthy food for the city's black population by providing breakfast in local schools, churches, and community centers. A small amount of this food came from small local gardens planted by BPP members. According to Prof. Nathan McClintock, "The Panthers used gardening as a coping mechanism and a means of supplementing their diets, as a well as a means to strengthen community members engaged in the struggle against oppression."^[84] The People of Color Greening Network (PCGN) was created in the 1990s. The group planted in empty and vacant lots in West

Oakland. In addition, schools around Alameda County began teaching basic gardening skills and food education.^[84] Other groups have carried on those legacies, such as People's Grocery^[86] and Planting Justice.^[87]

In 1998, the city of Oakland's Mayor's office of Sustainability proposed a Sustainable Community Development Initiative towards sustainable development.^[88] Due to West Oakland's lack of access to nutritious and healthy food, other organizations including the PCGN and City Slicker Farms demanded the plan include strategies for creating a sustainable impact within the local food system. City Slicker Farms was originally founded in 2001 in response to the lack of access to fresh produce in West Oakland. Through land donations from local residents, a network of urban farms was created through the Community Market Farms Program, and in 2005 the organization established the Backyard Garden Program to aid West Oakland residents in growing their own food at home. This program now grows upwards of 30,000 lbs. of food each year.^{[89][90]}

In 2005, Mayor Jerry Brown signed the UN World Environment Day Urban Environmental Accords, pledging Oakland to become a more sustainable city by the year 2012.^[91] This gave rise to Oakland City Council Resolutions, such as No. 76980 and No. 80332 which helped develop a Food Policy Council.^{[92][93]} It has teamed up with the Health for Oakland's People & Environment (HOPE) Collaborative, which works to improve the health and wellness of Oakland's residents.^[85] In 2009 the Oakland Food Policy Council started to plan urban agriculture in Oakland.^[94]

Canada

Canada has a number of companies working on urban farm technology including Lufa Farms and Alterrus Systems. In Montreal, there are 97 community gardens which allow citizens space in each plot to grow their plants. The program has been in place since 1975, and is managed by the boroughs. Of the eighteen boroughs, some have a gardening instructor who visits the gardens regularly to give gardeners tips. The soil, a water supply, a space for tools, sand, fencing, and paint are all provided by the city.^[95]

UK

Todmorden is a town of 17,000 inhabitants in Yorkshire, United Kingdom with a successful urban agriculture model. The project, which began in 2008, has meant that food crops have been planted at forty locations throughout the town.^[96] The produce is all free, the work is done by volunteers, and passers-by and visitors are invited to pick and use the produce.^{[97][98]} Some Todmorden plots have been permission plots while others have been examples of guerilla gardening. All are "propaganda gardens" promoting locals to consider growing local, to eat seasonal, to consider the provenance of their food, and to enjoy fresh.^[97] There are food plots in the street, in the health centre car park, at the rail station, in the police station, in the cemetery, and in all the town's schools.^[97]



Lufa Farms greenhouses are constructed on the rooftops of Greater Montreal.

Argentina

The city of Rosario (population: 1.3 million) has incorporated agriculture fully into its land use planning and urban development strategy. Its Land Use Plan 2007-2017 makes specific provision for the agricultural use of public land. Under its Metropolitan Strategic Plan 2008-2018, Rosario is building a “green 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 city has five garden parks – large, landscaped green areas covering a total of 72 ha of land, which are used for agriculture and for cultural, sports and educational activities.^[99]

Benefits

The benefits that UPA brings along to cities that implement this practice are numerous. The transformation of cities from only consumers of food to generators of agricultural products contributes to sustainability, improved health, and poverty alleviation.

- UPA assists to close the open loop system in urban areas characterized by the importation of food from rural zones and the exportation of waste to regions outside the city or town.
- Wastewater and organic solid waste can be transformed into resources for growing agriculture products: the former can be used for irrigation, the latter as fertilizer.
- Vacant urban areas can be used for agriculture production.
- Other natural resources can be conserved. The use of wastewater for irrigation improves water management and increases the availability of freshwater for drinking and household consumption.
- UPA can help to preserve bioregional ecologies from being transformed into cropland.
- Urban agriculture saves energy (e.g. energy consumed in transporting food from rural to urban areas).
- Local production of food also allows savings in transportation costs, storage, and in product loss, what results in food cost reduction.
- UPA improves the quality of the urban environment through greening and thus, a reduction in pollution.
- Urban agriculture also makes of the city a healthier place to live by improving the quality of the environment.
- UPA is a very efficient tool to fight against hunger and malnutrition since it facilitates the access to food by an impoverished sector of the urban population.

Poverty alleviation: It is known that a large part of the people involved in urban agriculture is the urban poor. In developing countries, the majority of urban agricultural production is for self-consumption, with surpluses being sold in the market. According to the FAO (Food and Agriculture Organization of the United Nations), urban poor consumers spend between 60 and 80 percent of their income on food, making them very vulnerable to higher food prices.

- UPA provides food and creates savings in household expenditure on consumables, thus increasing the amount of income allocated to other uses.
- UPA surpluses can be sold in local markets, generating more income for the urban poor.^[15]

Community centers and gardens educate the community to see agriculture as an integral part of urban life. The Florida House Institute for Sustainable Development in Sarasota, Florida, serves as a public community and education center in which innovators with sustainable, energy-saving ideas can implement and test them. Community centers like Florida House provide urban areas with a central location to learn about urban agriculture and to begin to integrate agriculture with the urban lifestyle.

Urban farms also are a proven effective educational tool to teach kids about healthy eating and meaningful physical activity.^[100]

Trade-offs

- Space is at a premium in cities and is accordingly expensive and difficult to secure.
- The utilization of untreated waste water for urban agricultural irrigation can facilitate the spread of waterborne diseases among the human population.^[101]
- Although studies have demonstrated improved air quality in urban areas related to the proliferation of urban gardens, it has also been shown that increasing urban pollution (related specifically to a sharp rise in the number of automobiles on the road), has led to an increase in insect pests, which consume plants produced by urban agriculture. It is believed that changes to the physical structure of the plants themselves, which have been correlated to increased levels of air pollution, increase plants' palatability to insect pests. Reduced yields within urban gardens decreases the amount of food available for human consumption.^[102]
- Studies indicate that the nutritional quality of wheat suffers when urban wheat plants are exposed to high nitrogen dioxide and sulfur dioxide concentrations. This problem is particularly acute in the developing world, where outdoor concentrations of sulfur dioxide are high and large percentages of the population rely upon urban agriculture as a primary source of food. These studies have implications for the nutritional quality of other staple crops that are grown in urban settings.^[102]
- Agricultural activities on land that is contaminated (with such metals as lead) pose potential risks to human health. These risks are associated both with working directly on contaminated land and with consuming food that was grown in contaminated soil.^[103]

Municipal greening policy goals can pose conflicts. For example, policies promoting urban tree canopy are not sympathetic to vegetable gardening because of the deep shade cast by trees. However, some municipalities like Portland, Oregon, and Davenport, Iowa are encouraging the implementation of fruit bearing trees (as street trees or as park orchards) to meet both greening and food production goals.^[104]

See also

- | | | |
|---|-------------------------------|-----------------------|
| ▪ Agroecology | ▪ Folkewall | ▪ Portable farm |
| ▪ Asset-based community development | ▪ Foodscaping | ▪ Public produce |
| ▪ Building-integrated agriculture | ▪ Forest gardening | ▪ Sheet mulching |
| ▪ Container garden | ▪ Gentrification | ▪ Shipping container |
| ▪ Compost | ▪ Good Agricultural Practices | ▪ Simple living |
| ▪ Ecological sanitation | ▪ Growbag | ▪ Sprouting |
| ▪ Farm City: The Education of an Urban Farmer | ▪ Guerrilla gardening | ▪ Underground farming |
| | ▪ Intercultural garden | ▪ Urban chicken |
| | ▪ Green wall | ▪ Urban horticulture |
| | ▪ Market garden | ▪ Urban forestry |

- Vertical farming
- Windowfarm

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External links

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- Placing the Food System on the Urban Agenda (<http://www.clas.wayne.edu/multimedia/usercontent/File/Geography%20and%20Urban%20Planning/K.Pothukuchi/foodsystemonurbanagenda.pdf>)
- Turning Shipping Containers Into Urban Farms (<http://www.smithsonianmag.com/ist/?next=/innovation/turning-shipping-containers-into-urban-farms-180953295/>)



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