Hort4EUGreen

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# URBAN HORTICULTURE

## Urban garden typologies and frameworks

## Volume 3

University of Agronomic Sciences and Veterinary Medicine of Bucharest
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ЛЕСОТЕХНИЧЕСКИ УНИВЕРСИТЕТ

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# Table of Content

# Volume 3. Urban garden typologies and frameworks

Milena Yordanova

## Introduction

Urban horticulture is a broad and complex field that brings together many different systems for growing plants in cities. It combines ecological thinking, new technologies and biotechnological tools to create practical models that respond to the specific challenges and opportunities of urban environments.

At the forefront of discussions surrounding systems for urban horticulture, is the imperative consideration of agroecological principles.

In the quest for optimized spatial utilization and resource efficiency, urban horticulture systems embrace innovative paradigms, such as vertical farming. This entails the strategic cultivation of plants in vertically stacked layers, effectively leveraging the vertical dimension to mitigate the patial limitations inherent in urban environments.

By doing so, urban spaces can be transformed into productive green zones, contributing not only to aesthetic enrichment but also to the sustainable provision of fresh produce. Urban horticulture brings together a range of scientific and practical approaches concerned with how plants are cultivated, managed, and integrated into the urban environment. The systems developed for this purpose respond directly to spatial constraints, infrastructural limitations, and the ecological pressures specific to cities. Within current debates on urban agriculture and green infrastructure, these systems are not peripheral solutions, but core mechanisms through which sustainable plant production and ecological functionality can be achieved in urban contexts.

By examining advanced cultivation techniques, green infrastructure strategies, and the use of emerging technologies, urban horticulture is positioned as a practical interface between plant systems and urban living. Rather than extending conventional agriculture into cities, it redefines how plant production and ecological functions are integrated within the built environment. This volume introduces the scope and relevance of urban horticulture and outlines the conceptual and applied dimensions that frame its analysis in contemporary urban contexts.

# Learning outcome descriptors

By the end of the module, the trainees should be able to identify and differentiate various urban garden types like rooftop and community gardens, analyze regulations and factors influencing urban garden planning and implementation, develop and present conceptual designs, considering sustainability and community needs.

## General and transferable skills

| | |
|---|---|
| 1 | Evaluate diverse urban garden types and regulatory frameworks. |
| 2 | Develop effective urban garden designs. |
| 3 | Apply sustainable solutions in varied community contexts. |
| 4 | Effectively convey urban garden concepts to diverse audiences. |
| 5 | Collaborate in group projects to implement urban garden frameworks. |

## Knowledge, understanding and professional skills

| | |
|---|---|
| 1 | Acquire knowledge and skills for effective urban garden planning and design. |
| 2 | Understand and apply eco-friendly principles in urban gardening for environmental stewardship. |
| 3 | Develop skills to engage and collaborate with local communities in urban gardening initiatives. |

# Volume 3. Urban garden typologies and frameworks

Milena Yordanova, Adrian Asănică,
Claudia Fabian

## Summary

Urban horticulture occurs in or near cities and involves different production methods, covering from small-scale household production and processing to large-scale commercial horticulture. Urban horticulture refers to the cultivation of plants for food and other uses within cities and their immediate surroundings, encompassing not only primary production but also activities related to processing and product distribution.

These systems are typically located in close proximity to consumer markets and operate under specific urban constraints, including competition for land, restricted growing space, and high environmental pressure. At the same time, urban horticulture makes use of locally available resources such as organic waste streams and, in some contexts, treated wastewater. Production is often oriented toward highly perishable goods, while organizational structures among producers remain limited or weakly formalized.

This form of agriculture complements rural agriculture by supplying perishable goods. What sets urban agriculture apart isn't just where it's situated or other mentioned factors, but its integration into the economic, social, and ecological fabric of cities.

Urban horticulture utilizes urban resources like land, labor, organic waste, and water, catering to urban residents.

Lack of jobs, and increasing urban poverty, together with unique urban advantages for gardeners (such as increasing demand for food, proximity to markets, and access to affordable resources such as organic waste and wastewater) have prompted the emergence of diverse agricultural systems in and near cities.

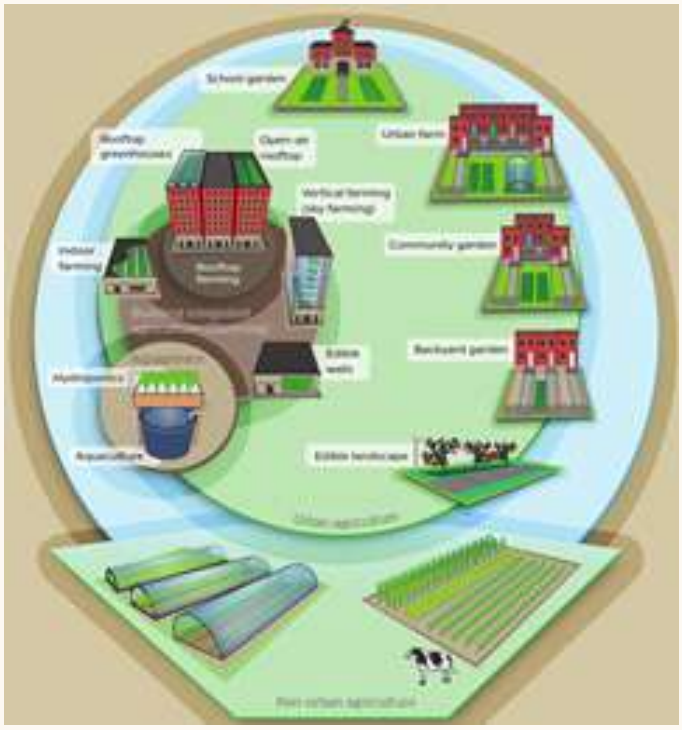
These systems often take advantage of available open spaces in urban areas. Although some urban and suburban systems make temporary use of vacant land, urban gardening itself is becoming a permanent fixture in many cities. Van (Veenhuizen, 2006).

# Unit 3.1 Systems for urban horticulture

Milena Yordanova, Gergana Mladenova, Vera Petrova,
Oana Venat, Viorica Lagunovschi-Luchian,
Claudia Fabian

## 3.1.1 Typologies of urban horticulture

One of the characteristics of urban agriculture is that it is implemented in a considerable variety of shapes and sizes, making it difficult to create a clear typology of urban agriculture systems. For example, Cilliers et al. (2020) enumerate 23 different urban agricultural systems described in the literature over a 15-year period (2004-2018).



Source: Santo, et al., 2016.

Attempts have been made to typologize urban agriculture systems, utilizing various sets of criteria. In 2011, Pearson et al., for the purpose of their research, grouped urban systems according to the distribution level of the produce. In the subsequent years, more comprehensive sets of criteria have emerged, generalized into larger categories.

Duží et al. (2014) propose four groups of criteria:

1. Place and space, location;
2. Stakeholder and organization;
3. Food security and performance;
4. Social change and innovations.

Glavan et al. (2015) are even more detailed, using seven groups of criteria:

1. Location of growing;
2. Type of growing substrate;
3. Legal method of growing;
4. Growing in relation to other plants;
5. Ownership of the growing space;
6. Legal (governance) type of growing activity;
7. Supply chain of the food produced.

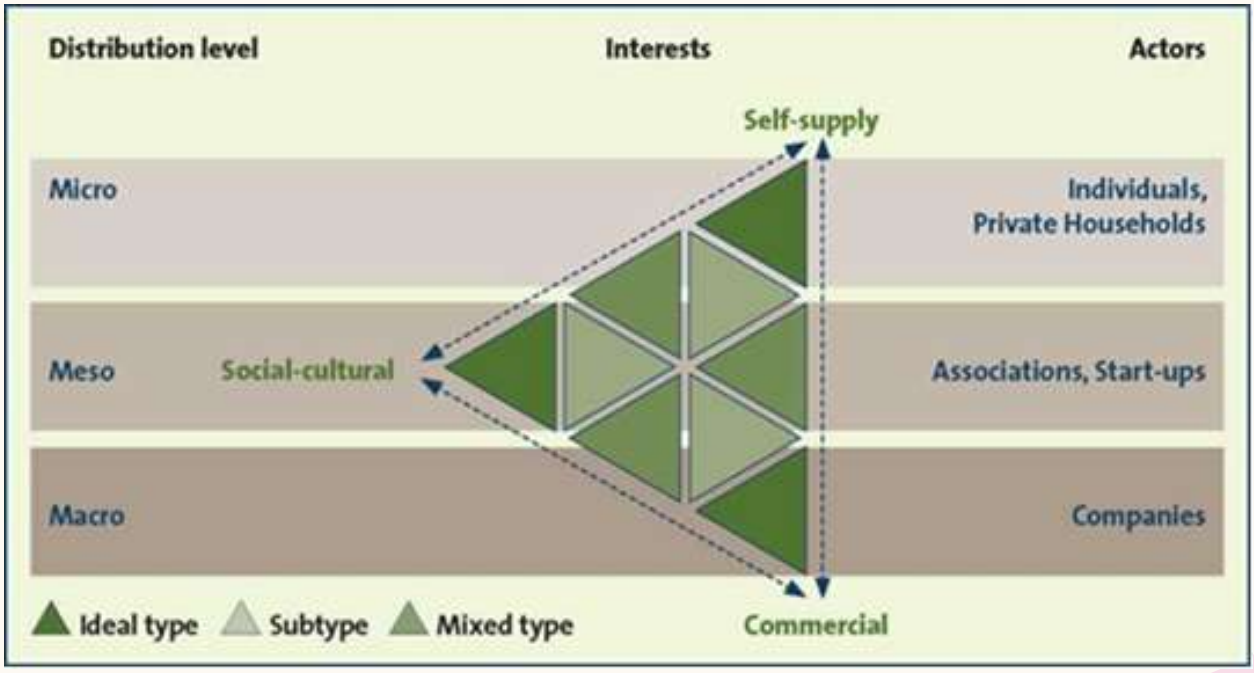
In their study, Nadal et al. (2015) define five primary types of urban agriculture along with their variations. According to them, the five main types are:

- Allotment gardens in the city;
- Agricultural gardens or urban parks;
- Rooftop gardens;
- Vertical gardens;
- Interior gardens.

They describe the various variations and compare them, examining different aspects depending on the benefits they

contribute related to sustainable development, and the scale at which a particular type or variation of urban agriculture is applied or developed. Additionally, they provide further classifications based on land use and the type and purpose of production. The study also highlights key technological solutions associated with the use of water, energy, and materials in different types and variations of urban agriculture. More information about this study can be found here.

Drawing on six distinct sets of criteria for typologizing urban agriculture, Krikser et al. (2016) propose a combination of these criteria to formulate three new types of urban agriculture: *ideal type*, *subtype*, and *mixed type*, based on the distribution level of the produce, the involved actors, and the predominant interests. In a pilot study, they applied this typology to examine 52 urban initiatives.




Source: Krikser et al., (2016)

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European Forum of Urban Agriculture use four main dimensions: the spatial, the operational, the production, and the community dimension, to identify six main types of urban agriculture (Müller, et al., 2022). The typology originates from distinctions outlined in Europe, initially formulated within the COST Action and expanded upon through the EFUA project funded by Horizon 2020. The COST project initially categorized urban farming and urban gardening, further breaking them down into 13 types. The EFUA project has

refined the original typology, delineating the distinction between gardening and farming more precisely. The survey is covering 112 Urban Agriculture initiatives across Europe (Merkle, 2023).

The researchers compared COST Action typology with the literature and the survey These six types, derived from the survey and supported by two other research methods, offer a refined differentiation between gardening and farming. They accurately represent the extensive range of urban agriculture practices in Europe, providing a more detailed and comprehensive classification that does justice to the diversity within urban agriculture performances across the continent (Jansma, et al., 2022).

| Cost Action (2016) | Literature review and interviews (this report) | Survey (this report) |
|---|---|---|
| Urban farming | Urban farms | Urban farm |
| | | Zero acreage farm |
| | | Social farm |
| Urban gardening | Individual urban gardens | DIY garden/farm |
| | Community Gardens/Collective Gardens | Community Garden |
| | Landscape-integrated UA | Community park |

Source: Jansma, et al.,. (2022)

But Merkle (2023) said that because of the biggest variety of different types, there are some gaps between them, as he said “there are grey zones between types”. So, the author

described another typology given by Payen et al. (2022), in which the main categories are the urban spaces (Gray spaces and Green spaces) which contain different subcategories.

**Systems typology in the digital and circular age**

Traditional typologies of urban horticulture (Pearson et al., 2011; Krikser et al., 2016; Müller et al., 2022) classified gardens based on distribution scale, social purpose, or physical location. However, recent advancements require the inclusion of technological, environmental, and governance dimensions. A proposed contemporary classification recognizes four **key systemic categories**:

**Agro-digital systems (smart urban horticulture):**
These systems utilize AI-driven sensors, Internet of Things (IoT) networks, and data analytics to optimize irrigation, lighting, and nutrient delivery. Digital twins - virtual replicas of gardens - are increasingly used for monitoring plant health, energy consumption, and carbon sequestration.

Automated vertical farms such as Infarm (Germany) and Eden Green (USA) represent leading examples of digitally integrated horticulture.

### Circular bioeconomy systems:

These models integrate horticultural production into circular urban metabolisms. Waste from households and restaurants is repurposed into compost or biogas, while greywater and rainwater harvesting systems reduce water dependency. Projects such as Biopark Terneuzen (Netherlands) and Urban Crop Solutions (Belgium) demonstrate how closed-loop resource cycles minimize ecological footprints.

### Hybrid agroecological systems:

These systems combine nature-based solutions (NbS) with technological components, promoting biodiversity while maintaining productivity. Examples include rooftop agroforests, pollinator corridors, and green facades designed to mitigate the urban heat island effect. Hybrid models are increasingly recognized for their contribution to urban resilience and microclimate regulation.

### Policy-governed systems (Urban Food Governance):

Urban horticulture has become a governance issue in many cities, integrated into urban food strategies and climate adaptation plans. Local governments in Paris, Milan, and Barcelona have adopted urban food charters that institutionalize horticulture as part of public infrastructure, fostering collaboration between citizens, policymakers, and researchers.

## Technological innovations and future directions

Recent innovations have shifted urban horticulture from a small-scale ecological practice into a data-intensive bio-industrial domain. The integration of Artificial Intelligence (AI), robotics, and renewable energy marks a turning point in the design and operation of horticultural systems.

- AI and machine learning:

Predictive algorithms can now anticipate pest outbreaks, optimize resource allocation, and fine-tune environmental conditions for individual plant species (Orsini et al., 2023).

- Automation and robotics:

Automated nutrient dispensers, robotic harvesters, and aerial drones enhance both productivity and safety in confined urban spaces.

- Decarbonized food systems:

Vertical and rooftop farms increasingly operate on renewable energy sources. Some urban greenhouses achieve net-zero emissions, aligning with the EU Taxonomy for Sustainable Activities (2024).

- Social and health innovations:

Urban horticulture systems are increasingly designed to support mental well-being, inclusivity, and public health, particularly after the COVID-19 pandemic (Piorr et al., 2024).

## Challenges and research outlook

Despite these advancements, several challenges persist:

- High energy demand in vertical systems requires more efficient renewable integration.
- Data privacy and governance in digital horticulture remain underdeveloped.
- Scaling social inclusion within highly automated environments is an ongoing issue.
- Policy harmonization across EU member states remains inconsistent, limiting knowledge transfer.

Future research should emphasize interdisciplinary frameworks combining horticultural science, data analytics, and social innovation. The next generation of urban horticulture will likely rely on AI-augmented agroecosystems capable of adapting autonomously to environmental and socioeconomic shifts.

# 3.1.2 According to their scale

Milena Yordanova, Vera Petrova,
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Oana Venat, Florin Stănică

Urban gardening can be analyzed according to its scale, where both the size of the cultivated surface and the purpose of production are interconnected dimensions of urban sustainability.

From this perspective, gardening in cities can be divided into three main groups: **Micro, Meso, and Macro gardening**, each reflecting different levels of space availability, technological involvement, and social function.

At the micro level, gardens are typically home-based and organized both within and outside buildings — on balconies, terraces, rooftops, or small ground plots that rarely exceed 500 m².

This scale primarily involves individuals and private households, yet its cumulative effect on urban ecology is

significant. In high-density cities, where per capita access to green space is often below 10 m² per inhabitant, microgardens represent a critical link between citizens and their immediate environment, restoring daily contact with nature (Pearson et al., 2011; Krikser et al., 2016; Mourad et al., 2023; FAO, 2021).

Microgardens can be private (family gardens, backyard plots, balcony or rooftop setups) or collectively managed (shared terraces, allotment parcels, or cluster gardens between residential buildings). In these gardens, vegetables, herbs, ornamental plants, and berry shrubs are the most common crops, often complemented by individual fruit trees or climbing species adapted to vertical surfaces.

Production technologies remain rooted in agroecological principles, using low-cost, circular solutions — e.g. mulching, composting from kitchen waste, rainwater collection, and irrigation through repurposed containers or slow-drip bottles. Such methods are especially relevant in compact urban zones, where water scarcity and heat stress have become major challenges for sustainable living.

Beyond food production, microgardening fulfills important psychological and social functions. It offers citizens opportunities for physical activity, aesthetic expression, and mental restoration within small domestic environments. Research shows that participation in small-scale gardening can reduce urban stress, strengthen social identity, and enhance emotional well-being, particularly for populations living in dense, high-rise neighborhoods with limited access to parks or yards. For many urban residents, a balcony garden or rooftop planter becomes a personal ecosystem — a space of agency, care, and contact with cycles of growth otherwise lost in the built environment.

Recent years have seen the emergence of technologically assisted microgardens, blending **traditional practices** with **smart tools**. Low-cost sensor systems, modular hydroponic units, and AI-supported irrigation kits such as PlantHive or Growbot now allow urban dwellers to monitor plant growth and optimize resource use via mobile applications.

These systems contribute to citizen science, generating environmental data on temperature, humidity, and $CO_2$ absorption, which can support municipal green policies and urban biodiversity mapping (Eigenbrod & Gruda, 2015).

Microgardens therefore act as distributed nodes in a living urban network, connecting domestic spaces to larger ecological and social systems.

They reinforce food literacy, biodiversity awareness, and community resilience, while symbolically reintroducing nature into the rhythms of everyday city life.

As cities continue to densify, the collective impact of thousands of small gardens contributes measurably to urban cooling, $CO_2$ capture, and stormwater regulation — turning private balconies and rooftops into miniature climate infrastructures.

Thus, microgardening transcends its modest spatial dimension: it represents a new urban habitus, where the act of cultivation is both a gesture of ecological participation and a tool of human reconnection with the living environment.

# European projects relevant for microgardens / urban gardens

| Project | Description | Cities | Official link |
|---|---|---|---|
| **U-GARDEN (JPI Urban Europe)** | European interdisciplinary project that promotes urban gardens as a strategic element of sustainable urban development, through Urban Living Labs, community involvement, and decision-making tools. Purpose: the expansion of urban gardens and agroforestry experiences. (JPI Urban Europe) | Valencia, Gothenburg, Warsaw, Brașov & other participating European cities; focus on institutional capacity, governance, education, and social impact. (u-gardenproject.eu) | https://jpi-urbaneurope.eu/project/u-garden/ (JPI Urban Europe) |
| **CoFarm4Cities (Interreg Central Europe)** | Replicable models of urban farming and micro-gardens / peri-urban farming as climate-friendly instruments for the resilience of cities; pilot implemented in 5 Central European cities. (Interreg Central Europe) | Pilot sites: Budapest (HU), Zagreb (HR), Turin (IT), Ljubljana (SI), Krakow (PL); studied parameters include: governance models, co-farming, stakeholder involvement, education, and urban development. (Keep.eu) | https://www.interreg-central.eu/projects/cofarm4cities/ (Interreg Central Europe) |
| **FOODCITYBOOST (EU,ongoing 2026)** | Integrated approach for urban farming solutions at the European scale, developing indicators for the social, economic, and environmental impact of urban agriculture systems. (CORDIS) | Collaboration with more than 100 stakeholders and 6 urban case studies; parameters: performance indicators, urban policies, decision-making tools. (CORDIS) | https://cordis.europa.eu/project/id/101132315 (CORDIS) |

## Meso-scale systems

Meso-scale systems represent the intermediate layer of urban horticultural practice, operating at the level of neighborhoods, educational institutions, or community networks.

Unlike microgardens - focused on domestic or individual self-sufficiency - meso systems emphasize collective organization, shared infrastructure, and social participation. They form the connective tissue between individual initiatives and city-wide food networks, linking private and public spaces through community-based production models.

## Typologies and functions

At this scale, urban gardens often take the form of community farms, school gardens, institutional greenhouses, and cooperative allotments managed by associations or local councils. Their hybrid character combines social engagement, educational goals, and local food production, typically on areas between 500 and 5,000 m².

Meso-scale systems are central to the concept of “productive urban landscapes” — multifunctional spaces where food production coexists with biodiversity support and social interaction (Specht et al., 2020).

From a functional perspective, these systems integrate agroecological practices, composting hubs, and low-input technologies such as drip irrigation, rainwater harvesting, or shared tool libraries.

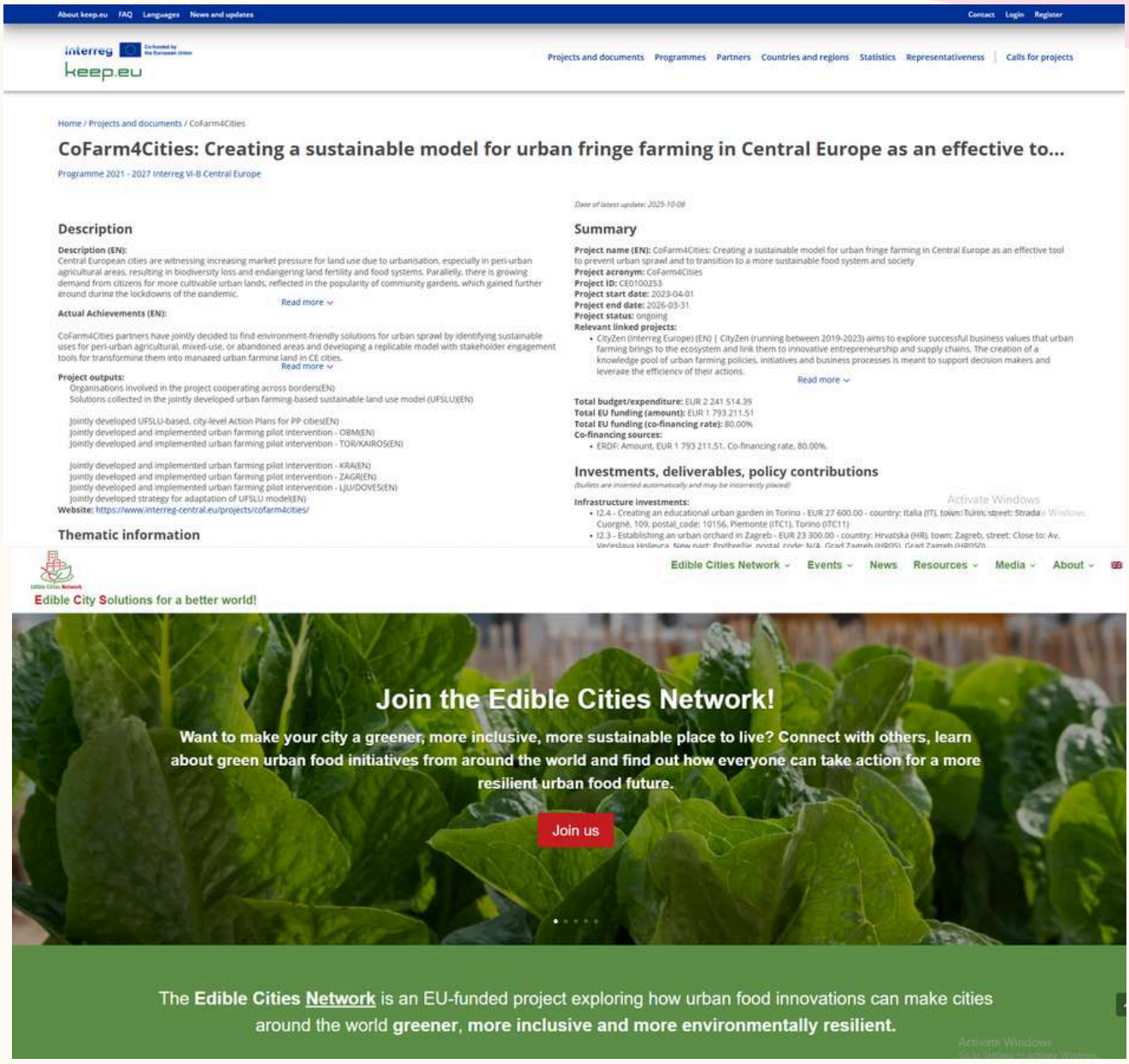
They often act as interfaces between citizens and institutions, helping municipalities test and scale up sustainable urban food policies.

Recent research highlights how meso-scale systems increasingly incorporate Controlled Environment Agriculture (CEA) technologies adapted to community settings.

Projects like **Edible Cities Network** (EU Horizon 2020, 2024) and **CoFarm4Cities** (Interreg Central Europe) demonstrate that small cooperative farms can employ automated climate control, LED-based plant growth systems, and nutrient recycling, while remaining socially inclusive and accessible (Kluczkovski et al., 2025).

For instance, in **Berlin's Prinzessinnengarten** and **Barcelona's Poble-sec Food Hub**, cooperative greenhouses use solar panels, automated ventilation, and substrate recycling to reduce resource consumption by up to 60% compared to open-field community gardens (Specht et al., 2020; de Carvalho et al., 2021).

Such hybrid systems represent the evolution of urban agroecology 2.0 - merging technological literacy with participatory governance and environmental awareness.




## Macro-scale systems: industrial and infrastructural latforms

At the macro scale, urban horticultural systems evolve into highly industrialized, technology-intensive infrastructures that integrate production, logistics, and energy systems within the urban fabric. Unlike micro- and meso-scale systems—based on community participation - macro horticulture represents the technological apex of urban food production, characterized by automation, artificial intelligence, and closed-loop resource management.

These facilities, often called plant factories or vertical farms, operate under full environmental control and are increasingly powered by renewable energy sources. Their design aligns with the principles of climate-neutral architecture and net-zero urban metabolism, transforming them into permanent elements of the urban infrastructure rather than experimental add-ons (FAO, 2021).

**Technological integration and AI-driven optimization**

Modern vertical farms such as **Nordic Harvest (Copenhagen)** and **Infarm (Berlin, Paris, Amsterdam)** employ advanced machine learning algorithms to optimize LED light spectra, nutrient dosing, and harvest cycles, significantly improving energy efficiency (Oh & Lu, 2023; Wang et al., 2023). The **Danish Nordic Harvest** facility, located in Copenhagen's industrial zone, operates on 100% renewable wind power, producing up to 1,000 tons of leafy greens per year on stacked hydroponic racks. Its AI-based monitoring system has demonstrated up to 30% reduction in electricity use while maintaining consistent yields (Simpson et al., 2025).

Similarly, **Infarm**'s modular vertical units installed in retail stores and distribution centers across Europe represent a decentralized production model, reducing food miles and post-harvest losses by nearly 90%.

Recent macro-scale prototypes - such as **Urban Crop Solutions (Belgium)** and **Spread Co. (Japan-EU)**—integrate AI decision engines with blockchain-based traceability to ensure food transparency and minimize waste across the supply chain. These digital-agricultural synergies are central to the European Green Deal's Farm-to-Fork Strategy, which emphasizes localized, low-impact food systems within smart cities.

In Romania, the company **Ultragreens** has emerged as a notable example of vertical farming adoption at the macro scale. In collaboration with Kaufland, Ultragreens inaugurated Green Hub Kaufland by Ultragreens, the first commercial vertical greenhouse in the country, with a 1 250 m² multi-level hydroponic production space designed for year-round cultivation of herbs and microgreens. The system uses LED lighting and hydroponic technology to reduce water use by up to 95 % compared to traditional agriculture, with rapid production cycles and pesticide-free growing.

Ultragreens is also scaling up toward larger automated facilities exceeding 6 500 m², where the entire production line —from seeding to harvest—is managed with minimal human intervention, aiming to support local supply chains with sustainable, high-quality produce.

**Circularity and energy sustainability**

Macro-scale horticulture contributes to urban circular economies by coupling food production with renewable energy generation, waste valorization, and water recycling. For example, the **Vertical Greenhouse prototype in Linköping**, Sweden - known as **Plantagon** - was designed to reuse industrial waste heat and $CO_2$ emissions for plant growth. Life Cycle Assessment (LCA) studies indicate that such integrated systems can reduce greenhouse gas emissions by up to 70% compared to imported fresh produce (Kowarik & von der Lippe, 2022).

New-generation European vertical farms incorporate rainwater harvesting, LED energy recovery, and greywater reuse, achieving near closed-loop cycles. Under the EU Taxonomy for Sustainable Activities (2023 update), controlled-environment agriculture now qualifies as a green investment category if powered primarily by renewable sources and maintaining resource circularity above 80%.

**Socio-economic dimensions and policy alignment**

Despite their technological efficiency, macro horticultural systems face challenges related to public acceptance, economic feasibility, and integration into local food cultures.

Studies (Akintuyi, 2024) highlight that successful urban vertical farms depend on alignment with local socio-ecological systems and citizen trust, especially regarding food safety and energy use.

To address this, the EU Mission for Climate-Neutral and Smart Cities (2030) encourages cities such as Copenhagen, Paris, Milan, and Rotterdam to embed vertical farming within participatory urban planning frameworks. This transition positions macro-scale horticulture as a strategic component of climate adaptation, combining digital agriculture with circular design and social inclusivity.

Macro-scale horticultural systems redefine the relationship between urban food production, technology, and sustainability. They function as “urban biotechnical infrastructures”, merging precision agriculture, renewable energy, and circular economy principles. Their long-term success will depend not only on technical innovation but also on their ability to embed human-centric values - equity, transparency, and ecological coherence - into the rapidly evolving landscape of urban horticulture.

The boundaries between micro-, meso-, and macro-scale systems are becoming increasingly porous. Modern cities exhibit multi-scalar horticultural networks, where domestic smart gardens exchange data with community hubs, and urban farms connect to renewable energy grids or wastewater recovery systems.

This systemic scaling allows urban horticulture to function as a distributed infrastructure, contributing simultaneously to food security, climate resilience, and social inclusion.

# 3.1.3 According to their location

Milena Yordanova,
Oana Venat

There are two directions for grouping urban gardens based on their location. On one hand, it depends on whether they are inside the city or on its periphery, and on the other hand, it depends on whether the gardens are organized on open land outside buildings or are situated in or on them (e.g., rooftop farming).

## Urban and suburban gardening

Urban gardening can be organized in various spaces: on smaller vacant plots within the city or in larger suburban areas where larger gardens and farms are typically found. Urban gardening can be *private*, *community-based*, or *corporate*. In major metropolises like Paris, New York, Tokyo, and others, there is a great diversity of examples of organizing urban gardening. It can manifest in various forms, including household and community gardens, urban farms, aquaculture, rooftop and vertical gardens, both in the central districts of these cities and in some peripheral neighborhoods (McClintock, 2014; Van Tuijl, et al., 2018).

Urban farms and gardens thrive near large markets with numerous consumers. Urban gardeners need to adapt to the more specific conditions of the city (Lohrberg et al., 2016).

## Gardens outdoors or indoors

Urban gardening can also be considered in terms of whether it is organized in open spaces (outside and around buildings) or indoors (inside or on buildings). It can also be viewed as traditional (in gardens, plots, or greenhouses) or in the so-called "zet farming" - on or within buildings (rooftop farming, terrace farming, vertical farming, cultivating plants in a fully controlled environment, etc.), where buildings may be specifically constructed for this purpose or old buildings may be repurposed for a second life (Van Tuijl et al., 2018).

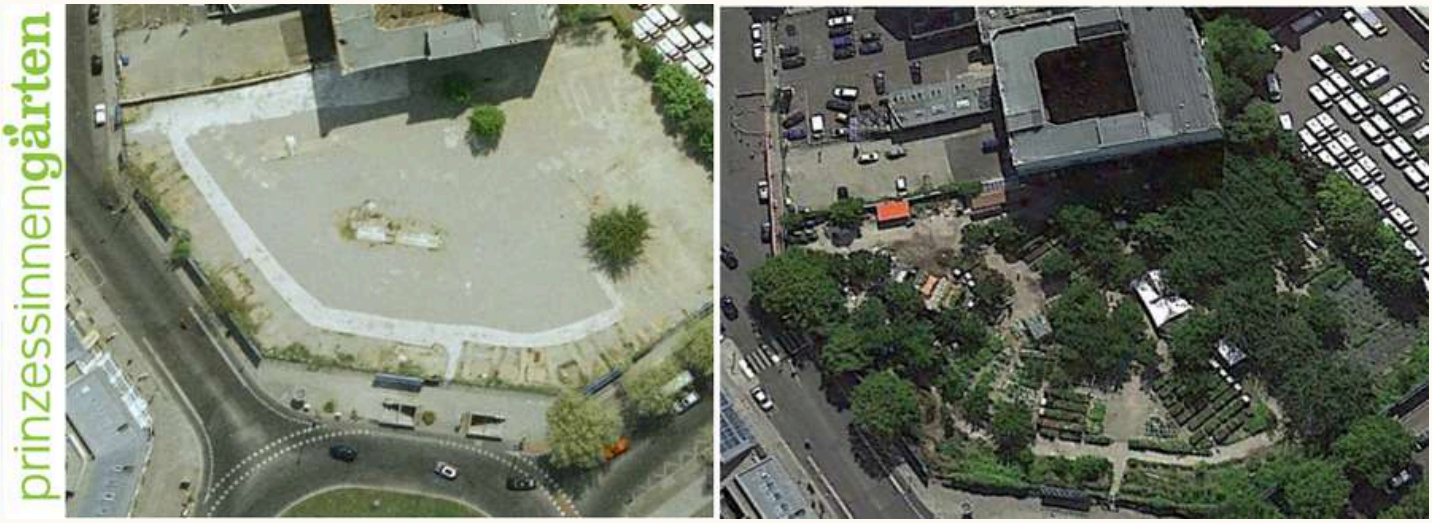
Most commonly, when organized in the central areas of the city, urban agriculture takes the form of rooftop gardens, terrace gardens, gardens in inter-block spaces, and educational gardens in schools. When organized in more peripheral neighborhoods, it can take the form of gardens in private homes, allotment gardens, organized in public spaces, as well as corporate gardens and larger farms.

**Examples of urban gardening depending on the location**

There are numerous examples of urban gardening worldwide. In the central districts of major cities, it often develops on building rooftops or inside the buildings themselves. One of the most popular urban gardens is located in Brooklyn, New York - Brooklyn Grange, founded in 2010. Brooklyn Grange manages two rooftop farms in Brooklyn where they cultivate vegetables, flowers, oil-bearing crops, and other plant varieties. You can find more information at https://www.brooklyngrangefarm.com/.

In Europe, one of the first rooftop gardens is Europe's first rooftop farm 'Dakakker' in Rotterdam, The Netherlands. It covers an area of 1000 m2 and cultivates vegetables, fruits, and flowers for consumption. Beehives are also located on the rooftop.


An interesting project in Berlin in the diverse city quarter of Kreuzberg creates a mobile urban farm called The Prinzessinnengarten, starting in the summer of 2009, and is a project by the non-profit company "Nomadisch Grün." Their aim is to temporarily transform some unused spaces (construction sites, parking lots, and rooftops) into urban agricultural land and green meeting spaces. Vegetables, herbs, and flowers are cultivated in raised compost beds, and the gardens serve as spaces for education, meetings, and relaxation for residents. More information can be found at https://prinzessinnengarten.net/about/.




A project for public gardens is Allmende Kontor - an urban garden located on the grounds of the Berlin Templehof Airport. In 1948-49, planes took off from there during the Berlin Airlift, and today, local residents cultivate fruits and vegetables. The initiative's goal is for people to experience "the province without leaving the city at all." Vegetables are grown in mobile raised beds, and digging in the soil is prohibited. More information can be found at https://inhabitat.com/a-community-garden-blooms-at-berlins-abandoned-tempelhof-airport/.

Prominent examples of indoor cultivation are centered around the concept of "vertical farming." It can be developed in old buildings as well as in modern ones specially constructed for these purposes. The world's first vertical farm, Sky Greens, is located in Singapore and serves as an innovative center for the holding company Sky Urban Solutions Holding Pte Ltd. It boasts low carbon emissions, incorporating a range of innovative solutions - the building is specially designed, hydraulically driven, for vegetable production using minimal land, water, and energy resources.

More information can be found at https://www.skygreens.com/about-skygreens/.

A vertical farm is located in a metro station in Seoul, South Korea, where the module can produce around 30 kg of fresh vegetables every day. More information can be found at https://www.sananbiofarm.com/case/smart-farms-sprouting-in-seoul-metro-stations. A similar module is used in a farm in Dublin, Ireland, with the goal of enriching and diversifying traditional vegetable production, achieving water and resource savings without being affected by climate change, and aligning with the objectives of the EU's "From Farm to Fork" strategy.

More details are available at https://www.sananbiofarm.com/case/grow-local-eat-fresh.

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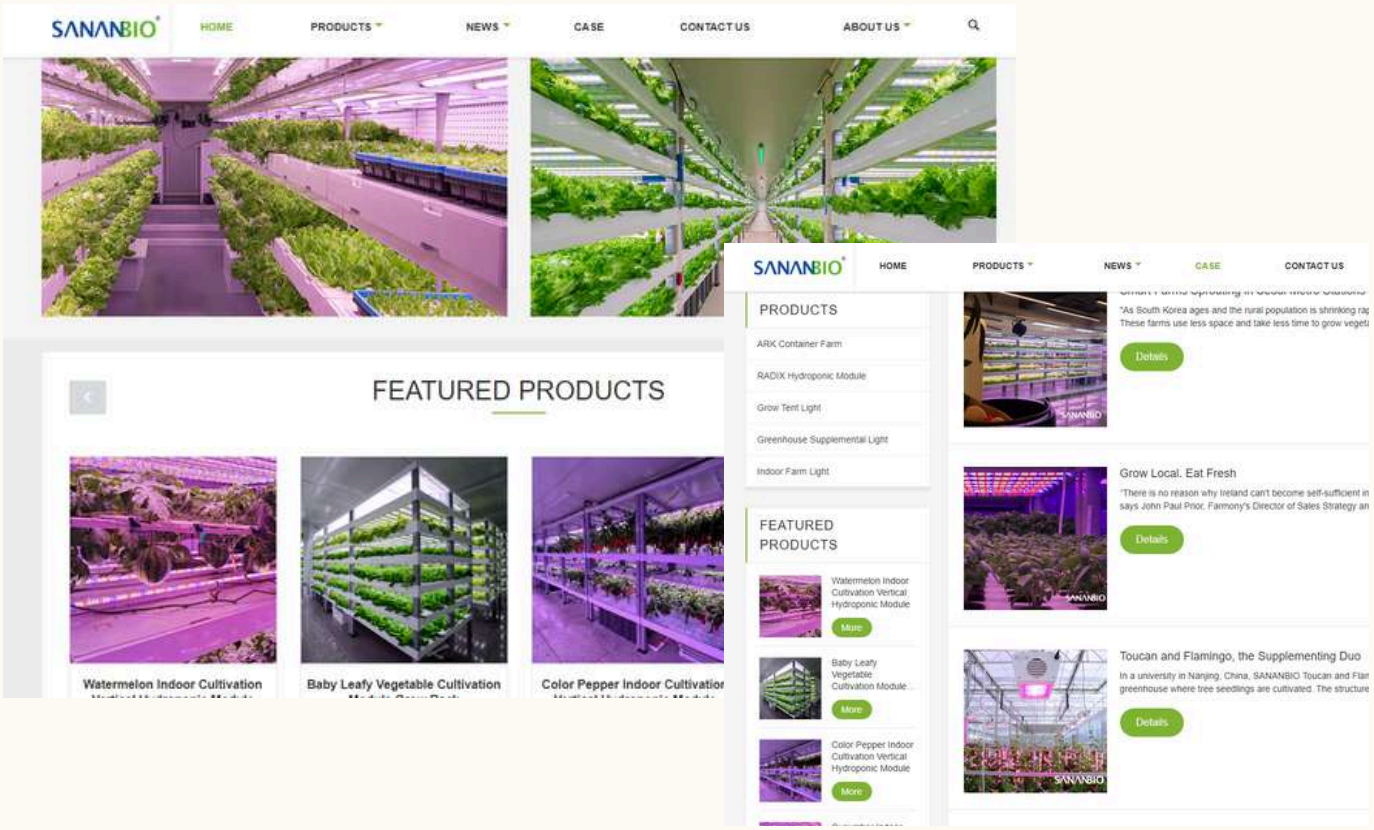
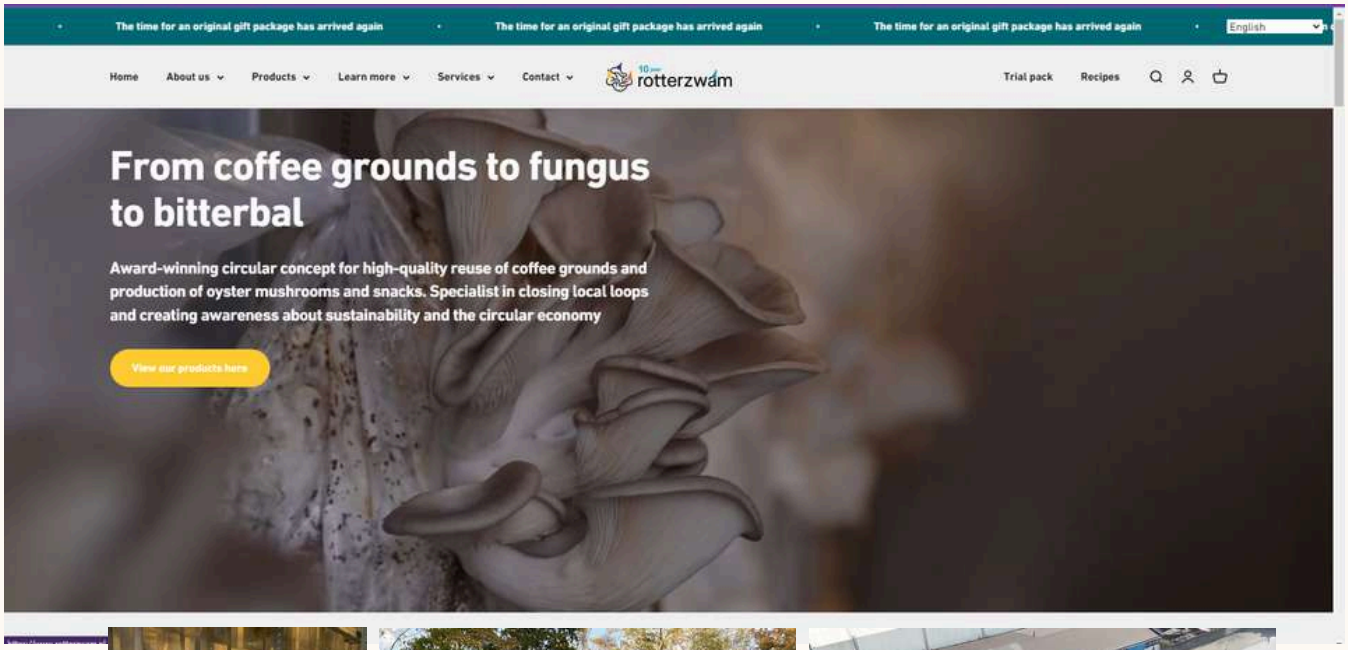


Another intriguing example of closed production is Rotterzwam, a mushroom producer and coffee bar located in a former swimming pool in Rotterdam. The company was launched in 2013 in the old Tropicana swimming pool (now BlueCity) on the Maas in Rotterdam. Their goal is to close the production cycle. They utilize coffee waste by turning it into a substrate for mushroom cultivation. Gradually expanding, they have earned numerous awards for their green initiatives. In 2020, they began cultivating mushrooms year-round rather than seasonally.

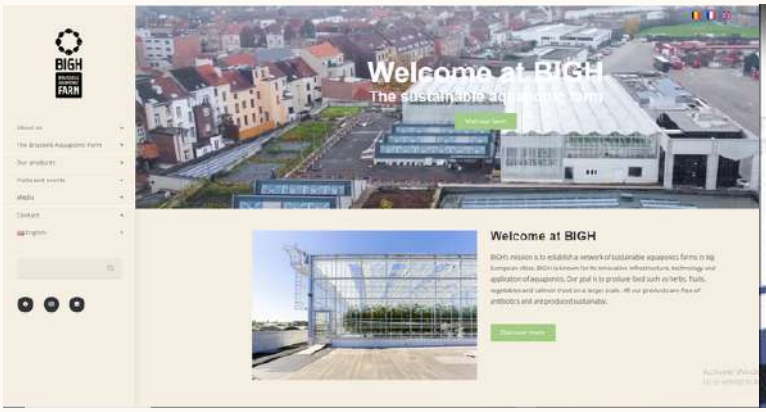
More information can be found at https://www.rotterzwam.nl/pages/missie.




**Urban gardens as circular and humanized urban interfaces**

In recent years, the role of urban horticulture within the city fabric has evolved from spatial occupation to ecological mediation. Gardens, greenhouses, and rooftop farms are increasingly perceived not as isolated “green islands,” but as interfaces - bridges between the built environment and urban metabolism. This transformation emphasizes the idea that location in horticulture is relational: it reflects not only where cultivation takes place, but also how it reconnects people, materials, and flows.

Projects such as **BIGH Farm** in Brussels and Groof (Interreg NWE) show how carefully integrated urban gardens can reuse heat, water, and $CO_2$ emissions from surrounding buildings while maintaining a strong community and educational component. Rather than functioning as sterile production sites, these spaces have become public pedagogical environments, where sustainability is lived, seen, and learned.

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**Urban Horticulture in circular metabolism**

Across European cities, new forms of horticultural localization emerge within the logic of urban circularity.

Some of the most visible examples include:

Agrotopia (Roeselare, Belgium) - a research greenhouse built atop a food distribution hall, demonstrating how industrial roofs can host public learning spaces and year-round local food production.

Images and resources: https://www.archdaily.com/976252/agrotopia-research-center-for-urban-food-production-van-bergen-kolpa-architects

BIGH Aquaponic Farm (Brussels, Belgium) - combining fish and vegetable farming in a rooftop loop that reuses building heat and water, proving that ecological balance and architectural elegance can coexist.

Visuals: https://bigh.farm

Groof Project (EU Interreg) - a transnational network developing rooftop greenhouses that feed buildings with fresh produce while recovering their waste energy.

Case visuals: https://vb.nweurope.eu/projects/project-search/groof/#tab-3

Pasona Urban Farm (Tokyo) – integrating edible plants inside an office tower, reminding that urban farming can reintroduce nature inside human activity spaces.

Photo references: https://konodesigns.com/urban-farm/

# 3.1.4 According to their purpose

Roxana Ciceoi, Milena Yordanova,
Claudia Fabian

Urban gardening projects are increasingly recognized as multifunctional systems whose objectives extend well beyond food production alone, particularly in densely populated urban environments where access to green spaces and local food systems is limited. According to data from the Food and Agriculture Organization, more than 55% of the global population currently lives in urban areas, a proportion expected to reach nearly 70% by 2050, intensifying pressure on food systems, social infrastructure, and public health. In this context, urban gardening initiatives have emerged as adaptive responses to multiple urban challenges, responding simultaneously to economic, social, educational, and health-related needs.

The purpose of an urban garden is therefore not fixed, but rather shaped by local conditions such as land availability, demographic structure, governance frameworks, and funding mechanisms. For example, cities such as Berlin, Paris, and Rotterdam have integrated urban gardening into broader urban development strategies, supporting projects that range from small-scale community gardens to commercial rooftop farms exceeding several thousand square meters.

Available resources, stakeholder involvement, and long-term strategic goals play a decisive role in determining whether an initiative prioritizes income generation, educational outcomes, or therapeutic and social functions.

From a planning and governance perspective, defining the primary purpose of an urban gardening project is a crucial step, as it directly influences its design, scale, management structure, and expected outcomes. Gardens developed with an economic focus often prioritize productivity, efficiency, and market integration, aiming to supply local markets, restaurants, or short food chains. In cities such as London and Milan, urban farms operating on vacant land or industrial rooftops have demonstrated the capacity to produce several tons of fresh vegetables annually while creating employment opportunities and contributing to local economies. In contrast, gardens oriented toward education or therapy emphasize accessibility, participation, and experiential learning, frequently operating on smaller plots but involving a higher number of users relative to their size.

In practice, however, these purposes are rarely mutually exclusive. Many urban gardening projects integrate multiple functions simultaneously, reflecting the complex nature of urban sustainability challenges. A garden initially established to enhance food self-sufficiency may gradually incorporate educational programs for schools or community groups, while therapeutic gardens may also contribute to local food provision. This multifunctionality is increasingly recognized by municipal authorities, who view urban

gardening as a cost-effective tool capable of delivering environmental, social, and economic benefits within a single spatial intervention.

The classification of urban gardens according to their purpose allows for a clearer understanding of their role within urban systems and facilitates the comparison of different models and practices across regions. Such a classification supports decision-makers, practitioners, and community organizations in selecting appropriate approaches that align with specific objectives, institutional capacities, and target groups. Moreover, recognizing the diversity of purposes highlights the potential of urban gardening as a practical instrument for addressing broader societal issues, including food security, environmental awareness, social cohesion, and public health, particularly in vulnerable urban communities.

From an economic perspective, urban gardens can be for self-sufficiency, business-oriented, or mixed – combining self-sufficiency with supplementing household income. Urban gardening with a business focus can also be diverse. It can be on a larger scale – supplying produce directly to the market. Alternatively, it can be to complement production (such as gardens for restaurants or vertical gardens for supermarkets, providing fresh herbs and vegetables).

While economic objectives often represent a primary motivation for initiating urban gardening projects, they are rarely pursued in isolation. Even gardens with a strong market orientation tend to generate additional social and environmental benefits, such as strengthening

local food networks, reducing food miles, or promoting sustainable production practices. These indirect effects further contribute to the overall value of urban gardening within cities and support its integration into local development strategies.

At the same time, urban gardens frequently serve as spaces for learning and knowledge exchange, regardless of their initial purpose. Practical engagement with food production creates opportunities for informal education, skill development, and intergenerational learning. This educational dimension is particularly relevant in urban contexts, where direct contact with agricultural processes is often limited. By reconnecting urban residents with nature and food systems, urban gardens help foster environmental awareness and responsible consumption behaviors.

The multifunctionality of urban gardening also enables projects to address social challenges, including social exclusion and reduced access to green spaces. Gardens that incorporate educational or community-oriented objectives often become meeting points for diverse groups, encouraging cooperation and participation. Through shared activities, participants can develop a sense of ownership and belonging, which contributes to stronger community ties and improved social cohesion.

As urban gardening initiatives continue to expand and diversify, the distinction between different purposes becomes increasingly fluid. Economic, educational, and therapeutic functions frequently overlap,

reinforcing one another and enhancing the overall impact of the project. Understanding these interconnections is essential for designing and managing urban gardens in a way that maximizes their contribution to sustainable urban development.

Urban gardening can have an *educational purpose*. Typically, projects aim to create gardens in kindergartens, schools, vocational high schools, or universities. They usually involve small to medium-scale production, with the gardens serving as educational tools staffed by trained and additional personnel. The produce is used for self-sufficiency (direct consumption or in cafeterias), and sometimes it is offered in the market to support education or for charitable purposes. They can be scientific gardens, primarily found in universities or institutes on smaller areas. In these gardens, various methods and models, different materials, and technological elements related to the production of different plants are tested.

Gardens can also serve *therapeutic purposes*, linked to the prevention and improvement of people's overall health, in which case the term "healing gardens" is used. Gardens can be focused on specific groups of illnesses or on patients with different deficits. In this case, the design includes the selection of container types, the height of the working area, the types of plants, and more. These gardens are designed to facilitate active engagement in gardening activities while ensuring a sense of safety and security. By their nature, they can be demonstration gardens or community-oriented, created for charitable purposes. More information you cand find here: https://networknature.eu/importance-therapeutic-gardens-within-urban-tissue

Another example of therapeutic gardens is the *Bethlem Royal Hospital Occupational Therapy Garden*. It provides assistance to individuals across the spectrum of mental health needs and other impairments. Established in 2007, it is designed for patients with a wide range of conditions. The diversity in gardens based on their purpose is continually enriched, and the mentioned example represents just a part of them.

More information you can find here: https://nhsforest.org/resources/bethlem-royal-hospital-occupational-therapy-garden/

Beyond economic, educational, and therapeutic functions, many urban gardens are also established with a primarily *environmental or ecological purpose*. These projects focus on improving urban biodiversity, restoring soil quality, reducing the heat island effect, and supporting pollinators such as bees and butterflies. Examples include the “Beehive Roof Gardens” in Copenhagen and the “Nature-Based Urban Gardens” network in Warsaw, which integrate native plant species and organic waste composting to reduce carbon footprints. In some cities, such as Barcelona and Amsterdam, urban gardens are directly linked to climate adaptation strategies, serving as small-scale green infrastructure nodes. This environmental function highlights the potential of urban gardening to act as a nature-based solution, reinforcing ecological resilience and contributing to the achievement of the Sustainable Development Goals (particularly SDG 11 and SDG 13).

# 3.1.5 Inclusive and accessible urban gardens

Oana Venat, Roxana Ciceoi

Urban gardening also plays a crucial role in promoting social inclusion and accessibility, particularly for individuals with physical or cognitive disabilities, the elderly, or socially vulnerable groups. Inclusive gardens are specifically designed to ensure equal participation, therapeutic engagement, and social interaction within urban green environments. Their purpose extends beyond rehabilitation, aiming to foster autonomy, dignity, and a sense of belonging through shared cultivation activities.

Such gardens are typically established in collaboration with local municipalities, social service providers, and non-governmental organizations. They can be developed within rehabilitation centers, day-care institutions, special schools, nursing homes, or public parks redesigned with accessible infrastructure. The design principles follow universal accessibility standards: raised beds between 70–80 cm high, wide paths allowing wheelchair access, adaptive gardening tools, and ergonomic seating. Sensory areas, featuring aromatic herbs or plants with contrasting colors and textures, are integrated to stimulate perception and memory for users with sensory or cognitive impairments.

In Europe, inclusive urban gardens are increasingly incorporated into the framework of “Green Care” and “Nature-Based Rehabilitation” initiatives. Successful models include the Jardin des Sens in Lyon (France), combining horticultural therapy with employment reintegration for people with disabilities, and the Green Care Farms network in the Netherlands, where gardening activities are part of daily programs for persons with dementia or mental health challenges. In Romania, similar initiatives could be implemented under Law no. 448/2006 on the protection and promotion of the rights of persons with disabilities and Law no. 292/2011 on social assistance, both emphasizing accessibility, community participation, and social inclusion.

The governance of inclusive gardens generally involves a multi-level partnership:

- Local authorities provide the land, utilities, and ensure long-term maintenance through public - private partnerships.
- Social service institutions and NGOs manage daily operations, coordinate volunteers, and supervise participants.
- Educational and healthcare institutions integrate horticultural activities into rehabilitation, therapy, and lifelong learning programs.
- Community volunteers and families strengthen sustainability and intergenerational bonds.

Funding opportunities are available through European mechanisms such as the European Social Fund Plus (ESF+),

Horizon Europe – Cluster 2 “Culture, Creativity and Inclusive Society”, and the EU Urban Initiative promoting inclusive green infrastructure. Local partnerships with universities or companies may also support such projects under corporate social responsibility frameworks.

**Design and implementation criteria**

The planning of an inclusive urban garden requires a multidisciplinary approach involving urban planners, landscape architects, social workers, and therapists. The process begins with a needs assessment of the target group - identifying physical limitations, cognitive characteristics, and sensory sensitivities of potential users. Accessibility should comply with universal design standards (as defined by ISO 21542:2021 and EU Accessibility Act), ensuring comfort, safety, and usability for all participants.

**Key physical criteria include:**

- **Topography**: flat or gently sloping terrain (maximum 5% gradient), avoiding uneven surfaces or steps.
- **Paths**: minimum width of 1.5 m for wheelchair access, made of compacted gravel or resin-bonded surfaces that allow drainage but prevent slipping.
- **Raised beds**: height 70–80 cm, width 1 - 1.2 m, allowing access from one or both sides.
- **Seating and rest areas:** positioned every 15 - 20 meters, shaded and equipped with ergonomic benches and back support.

- **Signage:** large, high-contrast, tactile or Braille labels to identify plant species and garden areas.
- **Irrigation systems:** automated or lever-operated to reduce manual effort.

The design must also consider microclimate and sensory balance - providing adequate shade, avoiding glare, and reducing noise exposure. Visual contrasts (light and dark paving, colored edges) help users with low vision navigate safely. The overall layout should follow a clear hierarchy of spaces, combining open areas for group interaction with intimate corners for individual reflection.

**Plant selection and ecological considerations**

Plant choice plays a crucial role in inclusive garden design, as it determines both accessibility and sensory experience. The selection should prioritize non-toxic, low-allergen, and low-maintenance species, avoiding plants with thorns, sharp edges, or strong irritants.

**Recommended species include:**

- Aromatic herbs – lavender (*Lavandula angustifolia*), thyme (*Thymus vulgaris*), mint (*Mentha piperita*), and rosemary (*Rosmarinus officinalis*) for sensory stimulation.
- Soft-textured ornamentals – lamb's ear (*Stachys byzantina*), hosta varieties, and ornamental grasses.
- Bright, contrasting flowers – marigold (*Tagetes*), zinnia, and calendula, which aid visual orientation.

- Fruit and vegetable species - cherry tomatoes, lettuce, beans, and strawberries for hands-on engagement.

**Species to avoid:**

- plants with thorns or spines (roses, cacti, berberis),
- allergenic species such as birch (*Betula pendula*), cypress (*Cupressus sempervirens*), or ragweed (*Ambrosia artemisiifolia*),
- toxic plants like oleander (*Nerium oleander*), foxglove (*Digitalis purpurea*), or lily of the valley (*Convallaria majalis*).

Planting should follow seasonal rhythms to maintain visual and olfactory interest throughout the year, alternating flowering and foliage plants. Sensory gardens often employ zones organized by senses - touch, smell, sight, sound (grasses, bamboo), and taste (edible beds).

**Landscape and aesthetic principles**

The landscape composition of an inclusive garden is based on three key principles: functionality, orientation, and multisensory engagement.

1. Functionality ensures that all spatial components serve user needs - paths for movement, raised beds for interaction, and shaded areas for rest.
2. Orientation is achieved through clear visual axes, color-coded areas, and tactile ground textures that guide users naturally.
3. Multisensory engagement transforms the garden into a restorative space - sound (rustling leaves, water features),

touch (soft foliage, textured bark), and scent (aromatic plants) stimulate memory and emotion.

A well-designed inclusive garden also incorporates ecological principles: rainwater harvesting, composting, pollinator-friendly planting, and use of local materials. These sustainable features link accessibility with environmental responsibility.

Inclusive gardens require ongoing coordination between public authorities and community organizations.

- Municipalities provide land, basic infrastructure, and integrate these gardens into local green networks.
- Social assistance departments and NGOs oversee user programs, coordinate volunteers, and ensure accessibility






# Unit 3.2 Urban horticulture practice models

## 3.2.1 Family gardens

Milena Yordanova,
Viorica Lagunovschi-Luchian

Family gardens—often referred to as home gardens—represent one of the most widespread and adaptable forms of urban horticulture. Traditionally located in private yards, balconies, terraces, or rooftops, they allow citizens to cultivate vegetables, herbs, spices, and flowers for personal use, supporting food self-sufficiency and dietary diversification (Eigenbrod & Gruda, 2015; Matei, 2017; Židak et al., 2019).

**From private practice to social infrastructure**

In the last decade, and especially after the COVID-19 pandemic, home gardening has evolved from an individual hobby to a collective instrument of social well-being. This transformation aligns with the concept of community gardening, where shared or adjacent plots are used not only for food production but also for social inclusion, education, and psychological recovery. According to WHO (2023), urban community gardens have become vital "green social infrastructures" that mitigate stress and loneliness, particularly among the elderly and urban youth.

Across European cities, community gardens such as **Les Jardins Partagés (Paris)**, **Allmende-Kontor (Berlin)**, or Grădina MolCom (Bucharest) act as hubs of participatory urban ecology.

They combine low-cost cultivation technologies with inclusive activities - workshops, therapeutic horticulture sessions, and local food exchanges—strengthening neighborhood cohesion.

**Therapeutic and psychological benefits**

Research across Europe increasingly supports the role of horticultural practices in preventive mental health care. The Urban Mind Project (King's College London, 2022) found that short daily exposure to gardening or urban green activities improves mental well-being scores by 15–25%. Similarly, the UK's Growing Health Project demonstrated that community horticulture can reduce mild depression and anxiety levels, while enhancing self-efficacy and social belonging.

The concept of Green Care - recognized by the European Federation for Green Care (2024) - promotes gardening as a form of social prescribing, where healthcare providers recommend nature-based activities as complementary therapy.

In this context, community gardens function as preventive care environments, integrating horticulture, social interaction, and mild physical activity. In contemporary community gardens, environmental awareness is closely intertwined with social value. Gardeners use recycled containers, rainwater harvesting systems, and composting to close resource loops and minimize waste. These practices embody a "micro-circular economy" that fosters both ecological literacy and community responsibility (FAO, 2021).

Recent EU initiatives such as U-GARDEN and FOODCITYBOOST support these hybrid models, framing community gardens as testing grounds for urban resilience, education, and green innovation.

By merging local food production with experiential learning, these systems contribute to the EU's Green Deal objectives and Sustainable Development Goals (SDG 3 – Good Health, SDG 11 – Sustainable Cities). Community and family gardens today transcend their traditional role as food sources. They have become living laboratories of urban well-being, fostering social connection, psychological recovery, and ecological education. Their future lies in integrating community-based horticulture within public health and urban planning systems—bridging the gap between environmental design and human flourishing.

**Examples and European context**

| City / Project | Type | Focus / Outcomes | Reference / Link |
|---|---|---|---|
| Allmende-Kontor (Berlin, DE) | Community garden network | Social cohesion, environmental education, women's participation | https://allmende-kontor.de/ |
| Les Jardins Partagés (Paris, FR) | Cooperative garden network | Mental health & inclusivity, community composting | https://jardinons-ensemble.org/ |
| Growing Health Project (UK) | National policy pilot | Green care, horticultural therapy, healthcare partnerships | https://www.growinghealth.info/ |
| Urban Mind Project (EU–UK) | Research collaboration | Mental health monitoring via nature exposure | https://www.urbanmind.info/ |
| Grădina MolCom (Bucharest, RO) | Community eco-garden | Intergenerational inclusion, permaculture, social reuse | https://gradinamolcom.ro/ |

# 3.2.2 Community gardens

Roxana Ciceoi, Oana Venat

In this type of gardens, there is a great diversity in terms of location, size, activities, and cultivated plant species. This diversity is somewhat influenced by the cultural traditions of the country in which this type of gardening develops.

A characteristic feature of these gardens is their contribution to community building. They are organized externally, within a specific neighborhood, and can be located in open spaces or on the roofs of public buildings. The area they cover can range from small to moderately large, resulting in a significant diversity of plant species. Here, the focus is not necessarily on the production of goods; rather, it is on community creation, emphasizing social activities.

Public gardens are located within neighborhoods and are maintained either by the participants in these gardens or with the assistance of local non-governmental organizations (Müller, et al., 2022). Although the goal is to create a sense of community, in these types of gardens, the entire area can be communal, with care shared among the people - meaning cultivation is collective. However, there can also be private plots where only tools or other facilities are shared. These gardens may serve to connect a larger group of people, but they can also aim to unite a smaller group with shared interests.

Public gardens can receive support not only from non-profit organizations but also from communities, sponsors, donors, or through various events. Since members of public gardens often span different ages, educational backgrounds, and financial capabilities, and typically lack gardening knowledge, these gardens often organize additional activities such as training sessions, seminars, competitions, concerts, and more to foster unity within the community. As the focus is not solely on production but rather on cultivating plants as an activity, these gardens showcase a great diversity of species and can act as semi-natural ecosystems within urban or suburban environments (Adam, 2011).

Despite the primary goal of fostering a sense of community, depending on the community's needs, another fundamental reason for organizing such gardens can be food production and, in this way, supporting the community. Through these types of public gardens, people's nutritional intake can be improved. Simultaneously, their knowledge of plants and cultivation methods can be enhanced, fostering a sense of belonging and, consequently, responsibility. Depending on the scale of the project, additional job opportunities can be provided, further improving the community's development conditions. Depending on the garden's location, similar to home gardens, plants can be grown in raised beds in the soil, but also in movable containers or various vessels (boxes, containers, bags, etc.) filled with compost or other organic nutrient media. Once again, besides vegetables, herbs, spices, flowers, berries, and other types of plants are cultivated (Eigenbrod & Gruda, 2015; Orsini et al., 2020).

One such community garden is located in Kotlaska in Prague, created in 2017. People with a criminal record are also involved in the garden's activities, with the aim of facilitating their integration. Besides vegetable production, this garden features designated areas for yoga, sports, relaxation, gardening, cooking, preserving, seminars, and a stage for performances.

Source: http://www.kckotlaska.cz/?ref=hypeandhyper.com

Another example of a community garden is Kisdiófa, located on Kisdiófa Street, opened in 2016 with the support of the Erzsébetváros municipality and professionally managed by KÉK, the Center for Contemporary Architecture. The garden is fenced and includes 44 individual and family plots, as well as 4 plots for schools and kindergartens. In addition to vegetable, fruit, herb, spice, and flower production, as well as composting, the garden hosts various events.

Source: http://kozossegikertek.hu/en/angol-oldal-1/

Varieties of community gardens include allotment gardens. Some authors categorize them as distinct types, while others consider them part of the same gardening concept, with minor differences in management.

According to Lohrberg et al., (2016), an allotment garden is an area divided into small plots that are rented out. They can be located on public land, and their organization and management are carried out with the assistance of a gardening association or another body based on public or private initiative. These are the first urban gardens that emerged in the 18th century, with the initial goal of helping people cope with poverty and hunger during wars. In contemporary urban gardening, besides supporting households, the development of urban

gardening is revitalized due to the leading idea of easily accessible healthy food. Motivations for the social environment, physical activity, mental relaxation, and health also become prominent. In many Western European countries, waiting lists are created for the allocation of these plots, which are not only rented to individual people or families but also to associations or other organizations responsible for their distribution.

An example of such distribution is the **Geitmyra garden** in Oslo. It was established in 1909 as a school garden and served as a center for school activities, with up to 13 schools managing school gardens in the area. In the 1980s, they began to reduce their activities, and some areas started to become neglected. Nowadays, school gardens are experiencing a resurgence, with at least 17 schools and several kindergartens having fields and engaging in activities at Geitmyra.

In addition to them, part of the land is managed by Parsellhagelaget, founded in 2006. In collaboration with the manager of the school garden, they are responsible for renting out plots. They have 220 plots, with over half leased by families with children, and tenants come from over 30 nationalities.

There is a registration fee for the land and an annual rent for the plots. https://geitmyraparsellhagelag.no/category/1

# 3.2.3 Gardens with social functions

Oana Venat, Adrian Asănică

## *Social gardens*

Social gardens are oriented towards different groups of people, combining urban gardening with social care at their core. They involve a wide range of activities and interaction with the natural environment.

Social gardens can assist individuals facing social challenges in reintegrating into society by involving them in the cultivation of various plants and taking care of them. Through this engagement, they acquire new skills, participate in various activities, and feel valued. Social gardens implemented in nursing homes help residents feel better by involving them in plant care, both mentally and physically (Matei, 2017; Piorr, et al., 2018).

Social gardens are organized in open urban spaces, and their size can vary from small to medium-sized areas. They cultivate a wide variety of plant types, including vegetables, fruits, flowers, herbs, and spices. Non-profit organizations (NPOs), non-profit-focused organizations, farmers, and others may be responsible for maintaining these gardens (Müller, et al., 2022).

In Berlin, Germany, the "Soulgardenberlin" project uses gardening to help refugees connect with local residents and their surroundings.
An example of such social gardening is the "Coco Velten" project in Marseille, where a 4000 m² building houses a homeless shelter, and shared gardens are organized around the building. The aim is to support the social and professional reintegration of these individuals through experimental gardening, composting, and promoting biodiversity. Source here.

Shared Gardens in Marseille

Such a 'Shared Garden' also exists in Sofia, Bulgaria. It cultivates vegetables that are used to provide food for those in need, organized by the informal movement 'Food, Not War.' The garden is maintained by volunteers.

## *Therapeutic Gardens*

In general, therapeutic gardens can help integrate people in disadvantaged situations due to various deficits, as well as individuals who have experienced significant stress, through gardening activities within them. However, therapeutic gardens can also focus on the treatment of people with mental illnesses, traumatized individuals, or patients with physical disabilities (Piorr et al., 2018).

An example of a therapeutic garden is the **Living Lab Zagreb** in Croatia, which is part of the proGIreg project - “Productive Green Infrastructure for Post-industrial Urban Regeneration” funded by the European Commission under Horizon 2020. The garden is located in eastern Zagreb within a former industrial complex. The goal is to provide not only a gardening space for people with disabilities but also opportunities for social interaction and relaxation. The garden is managed by the City Office for the Economy, Sustainable Development, and Strategic Planning, with daily activities overseen by the daily center for children with disabilities, Mali dom.

The therapeutic garden in the Sesvete neighborhood in Zagreb is designed and used throughout the year by various groups of people of all ages with different types of disabilities. It features different zones specifically designed to enhance the motor, sensory, cognitive, emotional, nutritional, and social potential of these individuals.


https://progireg.eu/nature-based-solutions/community-based-urban-farms-and-gardens/#c226

Sensory path in therapeutic garden
https://progireg.eu/zagreb/

# *Educational Gardens*

Gardens with educational purposes can take various forms – from community gardens organizing seminars and workshops with practical training for the members of the garden and the community, to urban gardens organized in different educational institutions (kindergartens, schools, universities, etc.).

In educational gardens, participants learn not only how to cultivate plants but, depending on the set goals, seminars are conducted on additional topics related to urban gardening: selection of species to increase biodiversity, choice of eco-friendly technologies for preserving and improving the environment; use of cultivated plants related to people's healthy lifestyles (for alternative treatment and nutrition); beekeeping and attracting other pollinators, and methods for planting, handling food, and raising awareness about the environment and nutrition.

Educational gardens can be complemented by scientific ones. Both educational and scientific gardens can be public or private, varying in size – from growing plants in pots, small-sized raised beds, or rows located in the courtyards of institutions to larger areas.

The cultivated plants can be diverse, including vegetables, herbs, spices, flowers, berries, fruit trees, and more. They can

serve to demonstrate to children how to grow plants, production technologies, schemes for independent or mixed cultivation of plants, experimentation with different varieties, technologies, or production schemes and more.

One interesting example of an educational garden is the school garden at UWC Robert Bosch College. It is a former monastery garden officially serving as an educational space since 2016. Located on 0.2 hectares, educators work alongside four groups of students who have the opportunity to receive training in organic gardening, integrated into the curriculum. In the garden, students work during both summer and winter, cultivating around 400 crops. Since September 2018, there is also a hand-built clay oven for baking. Additionally, the garden hosts bees, ducks, and chickens.
Source here.

In recent years, the social function of urban gardens has expanded beyond community interaction and local food production. More and more, they are being recognized as spaces that nurture mental health, emotional balance, and social inclusion. Especially after the COVID-19 pandemic, many European cities have started to view gardens not only as community projects, but as part of their public health infrastructure.
The concept of **Green Care** - using nature-based activities such as gardening to improve physical and psychological well-being - has become increasingly popular.

Through initiatives known as social prescribing, doctors and community workers in several countries now recommend participation in gardening or outdoor activities as a complementary form of care for people experiencing stress, anxiety, or loneliness. Research shows that even short periods of gardening can help reduce cortisol levels, improve sleep quality, and strengthen emotional resilience.

Projects such as the **Growing Health Project** (UK) and the **Urban Mind Initiative** (EU) provide scientific evidence that engaging with plants and soil enhances concentration, emotional stability, and feelings of belonging in urban environments. These gardens are often designed to be inclusive spaces, welcoming elderly people, migrants, students, or individuals recovering from illness.

Many urban gardens now combine education and therapy, helping participants learn ecological skills while restoring social confidence and connection. Such examples show that gardens are not only places for cultivation, but also spaces for healing, learning, and rebuilding communities in the post-pandemic city.

Today, the “social” dimension of horticulture means more than shared work - it means shared care: for people, for the environment, and for the future.

*Prison gardens and horticultural programs in correctional facilities*

Prison gardens are a specific form of gardens with social functions in which horticulture is used inside secure institutions to support rehabilitation, health promotion, skills development and social reintegration. International human-rights instruments such as the UN Standard Minimum Rules for the Treatment of Prisoners (the "Nelson Mandela Rules") and the European Prison Rules (EPR) emphasise that imprisonment should have a rehabilitative purpose and that people in detention must have access to meaningful work, education, physical exercise and health-promoting environments, even if they do not name horticulture explicitly (van Zyl Smit, 2023). Within this legal and ethical frame, prison gardens have emerged as a concrete way to operationalise rights to rehabilitation, health and human dignity in everyday prison life (Smit, 2020).

**Legal and policy context for prison horticulture**

International prison standards now articulate rehabilitation as a positive obligation on states, not just an aspirational goal. The Mandela Rules require that prison regimes provide education, vocational training, recreation and programmes aimed at "the full development of the human person", with special attention to mental health and preparation for release (van Zyl Smit, 2023). European Prison Rules and the case law of the European Court of

Human Rights similarly interpret humane treatment to include access to purposeful activities, outdoor exercise and healthcare equivalent to that available in the community (Rogan, 2018).

Legal analyses show that these standards have shaped national prison laws and policies by positioning rehabilitation and health as central objectives of imprisonment rather than optional extras (Smit, 2020). In Europe, guidance from bodies such as the European Committee for the Prevention of Torture (CPT) stresses that prisoners should have daily access to fresh air, green spaces and constructive occupations, which creates a normative opening for horticultural activities in prison yards, courtyards and surrounding land (Keppler & Lesting, 2025).

From a broader public-health perspective, improving prison conditions is also linked to the Sustainable Development Goals (SDGs). Analyses of prison health and SDGs argue that investing in environments that support physical and mental health in prisons is essential for reducing inequalities and “leaving no one behind” (Ismail et al., 2021). **Horticulture can be read as one concrete strategy to implement these obligations by reducing stress, improving diet and creating safer, more humane spaces.**

The human-rights literature also underlines that the right to rehabilitation includes measurable access to programmes that build skills, enhance autonomy and support social reintegration (Nikoleishvili, 2025). Within this frame, prison gardens function simultaneously as:

- health-promoting spaces (supporting mental health, physical activity and contact with nature);
- vocational learning environments (horticultural skills, teamwork, responsibility);
- sites of everyday humanisation, counteracting overcrowding, monotony and institutionalisation;
- and platforms for staff–prisoner relationships based on collaboration rather than purely control (Mackay, 2020).

**2. Evidence on health, wellbeing and rehabilitation**

Empirical studies of horticultural programmes in prisons consistently point to five main effects:

Mental health and wellbeing

Horticultural programmes such as "Greener on the Outside for Prisons" (GOOP) in England report significant gains in mental wellbeing (WEMWBS scores), self-confidence and sense of meaning in life in systems with high suicide and self-harm rates (Baybutt, Dooris, & Farrier, 2018; Farrier, Baybutt, & Dooris, 2019). Post-pandemic analyses show that gardening supports resilience after extended cell confinement (Farrier & Baybutt, 2024).

## Reduced depression and anger

A 12-session horticultural therapy programme in a South Korean prison produced lower depression scores and higher self-esteem and life satisfaction, based on standardized psychological scales (Lee et al., 2020).

## Skills and employability

Evaluations from prisons in England and Wales indicate that training in gardening, work in greenhouses and nurseries, and accredited qualifications improve “work readiness” and employment prospects after release (Devine-Wright et al., 2019). These activities are increasingly linked to broader prison-education schemes considered central for resocialisation (Romero-Carazas et al., 2025).

## Prosocial behaviour and prison climate

Group-based gardening creates spaces for cooperation, dialogue and shared responsibility, which support more prosocial behaviour and contribute to a safer, more humane prison environment (Baybutt et al., 2018; Farrier et al., 2024).

## Potential impact on recidivism

Reviews of “green prison programmes” in the United States, including Insight Garden Program and Rikers Island GreenHouse, report self-reported reoffending rates as low as 10–24% among former participants, while emphasising the need for more rigorous controlled studies to confirm causal effects (van der Linden, 2015).


Welcome to our in-depth exploration of a hidden gem of rehabilitation and success, the Jailhouse Garden of Rikers Island" at Mud Hub's gardening corner; where we discuss all things greenhouse gardening! In this article, we will uncover the captivating story behind this hidden gem and delve into the reasons why it



## *Examples of good practice*

| No. | Program / Location | Country | Short description | Academic sources |
|---|---|---|---|---|
| 1 | Insight Garden Program (IGP), San Quentin Prison | USA | Eco-therapy and horticultural education program. | S. van der Linden, 2015, Criminal Behaviour and Mental Health |
| 2 | The Garden Project, San Francisco | USA | Integration of gardening with social justice. | [Same as above] |
| 3 | GreenHouse Program, Rikers Island, NYC | USA | Ecotherapeutic project with positive results regarding recidivism. | [Same as above] |
| 4 | Sustainability in Prisons Project, Washington | USA | Engagement in sustainable agriculture and environmental education. | [Same as above] |
| 5 | Sandusky County Jail Gardening, Ohio | USA | Local programme aimed at reintegration. | [Same as above] |
| 6 | Greening the Cage - Critical analysis of prison gardens | – | Studies the ambivalence of “green” reform in carceral systems. | Hazelett, 2022, Antipode |
| 7 | Halden Prison, Norway | Norway | Integration of green spaces and horticulture into carceral design. | Banerjee & Das, 2024 |
| 8 | Middledrift Correctional Centre, South Africa | South Africa | Psychotherapy and gardening in correctional centres. | Kheswa & Lobi, 2014 |
| 9 | Luzira Prison Garden, Uganda | Uganda | Horticultural education as a method of rehabilitation. | Martha & Yawe, 2022 |
| 10 | APAC Model, Brazil (without police) | Brazil | Prisons without guards, based on spirituality and horticultural work. | Grossi & Augelli, 2025 |

*Prison horticulture projects: plants & technologies*

**Greener on the outside for prisons (GOOP) - UK**
Plants: seasonal vegetables, aromatic herbs, ornamental flowers, trees.
Technologies: outdoor therapeutic gardens, greenhouses, composting.
Source: Devine-Wright et al., 2019

**Horticultural therapy in South Korea** (12-session programme, K Prison)
Plants: vegetables, succulents, seasonal flowers.
Technologies: container cultivation, composting, manual irrigation.
Source: Lee et al., 2020 – Integrative Medicine Research

**San quentin insight garden program - USA**
Plants: vegetables, ornamental flowers, native plants.
Technologies: ecotherapeutic gardens, green roofs, environmental education.
Source: van der Linden, 2015 – Criminal Behaviour and Mental Health

**BOOM Tree nursery program - UK (for older prisoners)**
Plants: seedlings of native trees, ornamental plants.
Technologies: tree nurseries, environmental education, creative activities with plants.
Source: Farrier et al., 2024 – Ecopsychology

**Women's garden projects - USA**
Plants: vegetables, flowers, aromatic herbs.
Technologies: therapeutic horticulture grounded in clinical sociology, community gardens.
Source: Jauk-Ajamie et al., 2023 – Journal of Applied Social Science

**Horticultural therapy for adolescents in detention - South Korea**
Plants: ornamental plants, vegetables, cut flowers.
Technologies: sowing, planting, harvesting activities, post-harvest use.
Source: Park et al., 2022 – International Journal of Environmental Research and Public Health (IJERPH)

**Soilless cultivation technologies used in some advanced prison programmes (in small greenhouses).**
Technologies: artificial substrates, irrigation with nutrient solutions, hydroponic cultivation.
Source: Zhang et al., 2017 – ICESAME Conference

**Prisons are extreme urban spaces, but they still belong to the social fabric of the city. International standards now push them to be places that support health and rehabilitation, not only punishment. Within this shift, horticulture - in the form of therapeutic gardens, prison farms and nurseries - is a very concrete way to put these principles into daily practice. The evidence shows that such programmes can improve physical and mental health, build useful skills and support the reintegration of people leaving prison, which makes them a legitimate part of the wider story of urban horticulture in this volume.**

# 3.2.4 Zero acreage garden/farms

Oana Venat, Milena Yordanova,
Adrian Asănică

The concept of *Zero Acreage Farming* has evolved far beyond the idea of merely "soil-less cultivation." In 2026, **ZFarming** represents a philosophy of urban regeneration, reconnecting buildings, people, and ecosystems through productive, restorative, and educational spaces. This movement positions urban food production as part of the metabolic cycle of the city, where every drop of water, lumen of light, and gram of organic matter is purposefully reused.

**Net-Zero urban food systems**

Modern vertical and indoor farms have increasingly aligned with net-zero energy and emission goals. A new generation of ZFarming facilities integrates renewable energy, closed-loop irrigation, and nutrient recovery to achieve carbon-neutral food production.

A remarkable example is **Nordic Harvest** in Copenhagen, a vertical farm powered entirely by wind and solar energy. Its system recycles over 95% of water and operates with a $CO_2$-neutral energy profile, producing greens for local markets without relying on soil or fossil-based logistics. This model embodies a broader trend - urban food infrastructures that generate, rather than consume, resources.

Similarly, **Urban Crop Solutions** in Belgium designs modular farms that can be integrated into existing buildings or transport hubs. Their AI-guided LED systems adjust light spectra dynamically, reducing electricity consumption by up to 35% while maintaining crop diversity. These technological layers remain invisible to the human eye but quietly enhance resource circularity and climate resilience.

**Circularity and resource recovery**

ZFarming now plays a crucial role in the circular economy of cities. Water recovered from condensation, organic waste repurposed into biostimulants, and heat exchanged with neighboring infrastructures all contribute to a self-sustaining metabolic loop.

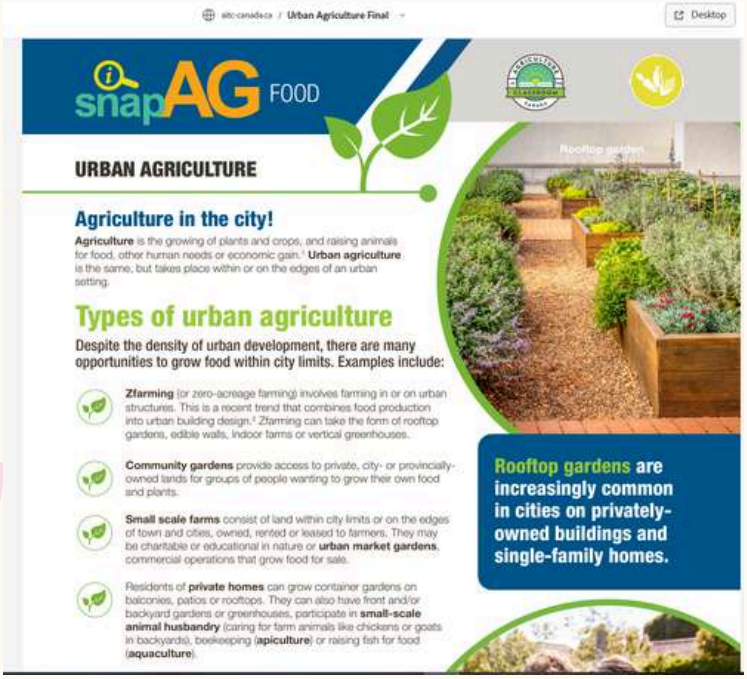
Examples across Europe illustrate this trend:

**Groof Project** (EU Interreg) integrates rooftop farms into energy systems, reusing heat from buildings and $CO_2$ from ventilation for plant growth.

**RotterZwam** (Netherlands) grows mushrooms in a former swimming pool using recycled coffee grounds as substrate, closing the loop between urban waste and urban food.

These projects demonstrate that the future of ZFarming lies not in isolation, but in integration - where every farm becomes a node in a regenerative network that supports both human life and urban ecology.

One form of urban gardening is Zfarming (or zero-acreage farming), where gardens are organized within or on top of old or new urban structures. The gardens can be arranged on rooftops, as vertical walls, on balconies, as well as inside the building itself, utilizing natural or artificial lighting.
Source here.




According to Eigenbrod and Gruda (2015), some of the first to describe this type of agriculture in the literature are Caplow (2009) and Specht et al. (2013). According to Caplow, this involves integrating hydroponic greenhouses into the energy and resource cycles of buildings. These greenhouses can be on rooftops, inside the buildings, or the buildings themselves can be designed for hydroponic cultivation of vegetables.

The efficiency can be expressed through waste management (recycling, composting), nutrient utilization, and energy consumption. Specht et al. describe this type of farming as Zero-acreage Farming, also known as **ZFarming.**

In terms of the efficiency of these systems, related to their environmentally friendly production, household and production waste can be utilized for composting and feeding the plants. To save water, rainwater harvesting systems are constructed and used for irrigating the plants.

These types of gardens can vary from high-tech (e.g., fully automated production with minimal human involvement) to low-tech with many manual activities. They can be created with non-profit goals or be entirely commercial. Zero-acreage farms are usually located in urban areas and have small footprints. Old abandoned buildings can be repurposed, new buildings can be designed with gardens, or structures can be specifically built for this purpose.

The characteristics of the space to be used as a garden are important; the cultivation of plants should be organized to support the greening of the building rather than causing harm. In this type of urban gardening, mainly plants (herbs, spices, vegetables, microgreens) are produced, along with mushrooms, bees (rooftop gardens), fish (aquaponics), and insects. The production can be used by those involved in the process, sold in part, or the entire yield can be distributed to various clients (restaurants, kitchens, markets, stores, etc.). In public Zfarming, educational visits are organized, along with various events such as tastings, among others (Müller et al., 2022).

# *Roof Gardening*

Roof gardens have the advantage of being located on non-agricultural land, which can reduce the use of polluted land and water and alleviate health concerns. Rooftop farming may be limited by the load-bearing capacity of the roof structure, its accessibility for people and agricultural materials and tools, as well as increased solar radiation and temperature ranges due to the unique characteristics of the region in which it is practiced. The challenges of rooftop farming are related to reducing installation costs, developing suitable practices, and others (Whittinghill and Rowe 2012; Caputo et al., 2017).

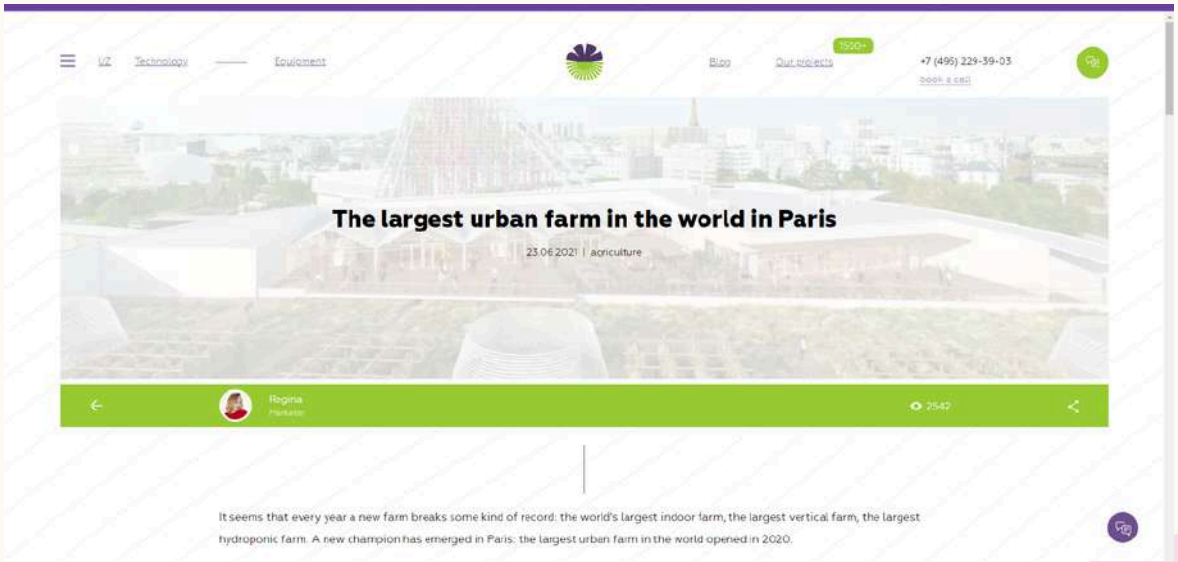
Roof gardening can be developed on old buildings, and in such cases, an additional assessment and reinforcement of the roof are carried out, and the production systems are configured according to the available space. When roofs are built specifically for this purpose, the structures are designed with the rooftop garden project in mind. Roof gardens on adapted roofs of old buildings still predominate, but there are also good examples of specially designed rooftop gardens on new buildings (Thomaier et al., 2015; Orsini et al., 2020).

The cultivation of plants on the roofs of buildings in cities can be done in an open (outdoor roof garden) or protected (roof greenhouse) environment. Soil-based (e.g., containers filled with soil) or soilless (e.g., hydroponics, aquaponics) systems are widely used in cultivation technologies. When proceeding with the construction of a roof greenhouse, the advantages mentioned are related to its integration into the building (linked to energy and the reuse of water and carbon). Very often, rooftop garden projects are associated with outdoor plant cultivation, using low-tech production methods (raised beds, capturing and using rainwater, etc.). Roof gardens have the advantage that plants, when elevated, are protected from atmospheric pollutants, and when hydroponics or aquaponics are used, the risks of pollution are minimized. Roof greenhouse production usually involves the use of more advanced technologies aimed at increasing production (Orsini et al., 2020).

Roof gardens can be public or private, including corporate gardens. In addition to production, they can be used for various public and private activities such as training sessions, different types of events, and more (Thomaier et al., 2015; Orsini et al., 2020).

In 2020, the largest rooftop garden opened its doors in Paris, France. Covering an area of approximately 14,000 m2, it brings together 20 gardens (farms) producing over 30 different plant species. Situated in the renovated exhibition center Paris Expo Porte de Versailles near the historic Marais district, the production incorporates aeroponic technologies for growing vegetables, with plants being cultivated in vertical towers. This method aims to yield around 900 kg of fruits and vegetables per day, with part of the production being used in its own restaurant.

Source here: https://agrovent.com/en/blog/the-largest-urban-farm-in-the-world-in-paris/



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