Phenomenon of Urban Agriculture and Its Role in Shaping Sustainable Cities

Kateryna Dorofieieva, Kristīne Vugule
Latvia University of Life Sciences and Technologies, Latvia

Abstract. The rapid growth and development of the world have lead to significant changes in the expansion of urban sprawl, land distribution, and the general functioning model of modern cities. The problems connected to ecology, economy, human physical and mental well-being become more urgent with every day under the influence of arising deficiency of open green spaces, nutritional security, and sustainable financial models for small-scale businesses within the cities; and not only affect regular citizens but also general tendencies of urban and landscape planning that are supposed to deal with those issues. One of the tools aimed at combating them for the past decades has been an increasingly popular urban agriculture, particularly chosen as a studying object of interest for this publication. The following paper represents complex research conducted in an integrated manner by reviewing the overall phenomenon of urban agriculture and its pioneering practices; determining the key components of their successful functioning and positive ways of affecting surroundings; and consequently forming the list of concluding recommendations for planning and management of such structures. As the main methods of research, the selective case study, describing principal features of such initiatives, and relevant literature analysis for the fundamental information gathering were applied by the author. The results of the research were composed into the summarizing table highlighting core data and supporting developed conclusion based on examination and designing suggestion for interested parties.

Keywords: urban agriculture, sustainable urban development, sustainable land use, resilient landscape design

Introduction

The ways of urban planning have been constantly changing under the influence of emerging needs of societies, economies, and politics. In the age of global development and growth of urban surroundings, the issue of inefficient land management within cities has started to resonate like never before, fuelled by attended problems with the environment, lack of community resources, and health concerns. If previously the main accent of urban development was centred on producing quantity, now the recent shift of human perception drives it towards quality, creating new sustainable tendencies of shaping our cities. Among rising innovative approaches over the past decade, the phenomenon of urban agriculture has been the one gaining the most attention due to the comprehensiveness of its methods, and wide range of exposure.

Urban Agriculture

Urban agriculture (UA) is defined as any kind of crop cultivation and production realised in domestic or public settings in urban or peri-urban areas [1]. Generally, it incorporates vegetable and fruit tree cultivation, but sometimes might be associated with the cultivation of medicinal, herbal, or ornamental plants [2]. In some cases, UA could be connected even with small-scale animal raising (e.g. various poultry breeds), apiculture (beekeeping), and aquaculture practices (a combination of mutually beneficial growing of fish and plant culture) [3].

Historically, UA has been present in the infrastructure of cities in a variety of forms since the dawn of time. As an instance, the Inca citadel Machu Picchu, dated the 15th century, had facilities for rainwater management, and specifically designed growing beds that captured a higher percentage of the sunlight [4]. Years later, it was reintroduced to Europe as a response to the poverty and food insecurity caused by economic crises and protracted wars. At the beginning of the 19th century, Germany came up with the idea of allotment gardens, which fed millions of people during depression times [5]. Almost the century after, the USA had developed a similar strategy establishing Victory gardens concept that supported many American families with the provision during the WWI and WWII [6]. Suchwise, UA has continued to arise in different parts of the world to date responding to the needs of the communities, whether they connected to political, economic, social, or environmental contexts.

Referring to the context of UA initiatives' appearance, their ways of realisation could be identified in the following types:

- Community gardens – self-assembled initiatives with a 'bottom-up' approach organized as a response to the social or economic issues inside the community [7].
- Allotment gardens – individual pieces of urban or suburban land officially provided for leasing by the government or privately owned by individuals for non-commercial cultivation of food and recreation purposes [8].
- Community farms – a professional type of UA initiatives based on the engaging community in small-scale food production operated and run by experienced farmers. In general, all the main decisions in regard to farm management, choice of

growing crops, and harvesting are taken by superior professionals while locals are welcomed to volunteer with routine tasks [9].

- Institutional farms and gardens – ones that belong to particular institutions such as schools, hospitals, or private companies. Their gardening practices are not connected to the food production itself, rather to its indirect benefits [10].
- Commercial urban farms – fully commercial subtype of UA established with the goal of maximizing the profitability of the crop production grown in the urban settings but with the emphasis on sustainable farming practices and sensitive approach to local ecology [11].

In practical terms, UA activities can be implemented by means of diverse techniques starting from classic direct open-soil gardening and ending with, high-tech techniques, such as vertical farming, aero- and aquaponics [12]. Overall, UA could take forms of raised bed/container gardening, shipping container farming, rooftop cultivation, greenhouse and tunnel growing, edible walls, or landscapes [13].

Benefits of urban agriculture. As it was defined before, UA has various ways of beneficial affecting of surroundings. Due to the constant mutual influence between UA and the urban environment itself, their relationship plays a crucial role in the formation of socio-economic conditions (food security, the health of inhabitants, level of poverty), contingent conditions (quality standards, land market prices, polices), and resource distribution (water, land, labour, organic wastes) within the cities [14].

Food and nutritional security. UA contributes to the food and nutritional security of cities, making food production more available, accessible, and stable for all social layers of the community [15], thereby providing them with all essential food components in nutritional terms [16]. As an instance, in a study conducted with the use of multivariate analysis devoted to the assessment of the impact the UA has on the dietary adequacy of people involved it, the results have shown that through means of urban cultivation, people received access to more nutritious, fresh, and quality products which in a turn improved their diets [17]. This, as well, allowed people with low income to considerably save a greater part of their money previously spent on food. Consequently, reduction of expenditure caused a general increase in income and led to poverty alleviation [18]. Likewise, food production within cities results in prolonging of the growing seasons due to microclimatic differences with the rural areas, as well as more accessible use of resources like water and electricity, availability of labour, and bigger percentage of non-flooded areas, what brings an enormous advantage in terms of longer and easier access to the fresh crops [19]. Another benefit in relation to food access is the possibility to shorten the number of intermediaries between producers and consumers during the supply

process what for its part also cuts time spent on those operations and helps to deliver products faster [18].

Economy. As it was previously mentioned, some types of UA initiatives function for commercial purposes only, what helps urban communities to create a disposable source of income and contribute to the development of local small-scale businesses [20]. UA creates job opportunities and triggers the growth of the economic activities related to farming (e.g. food processing, packaging, marketing, etc.), which in a turn provide the community with the working places [21]. It allows people to benefit with financial savings by means of growing their own food, and if the consumer isn't a grower, then through buying produce cultivated in the urban environments and supporting local communities, they still pay less as the price of these products is basically lower due to the absence of extra transportation costs occurring in cases where food is delivered from further locations [22]. In this way, micro and macroeconomics of the localities benefit on both levels, forming brand new individual consumer behaviour and tendencies of urban development.

Environmental impact. In terms of the larger-scale impact of UA, it is impossible to gloss over its general positive effect on the environment. Various kinds of pollution originated inside the cities, constitute a threat to public health and ecological balance as a whole. Cities are major emitters of greenhouse gas and produce over 70% of global CO_2 emissions in urban areas [23]. Besides that, existing waste management strategies for cities aren't sufficient enough and don't correspond to the actual challenges and needs of urban environments [24]. Conversely, in response to that, UA can propose the facilitation of sustainable ways for an alternative governing of ecological constituents of city spaces. Organic waste can be turned into compost furtherly used at the gardens for increasing production of fresh produce [25], sewage can be utilized for irrigation purposes and organic solid waste for fertilizing, meanwhile inorganic wastes (e.g. plastic bottles, tanks, storage boxes) will perfectly suit as an upcycled growing units for smaller crops [26]. The increasement of green spaces within the city positively influences urban microclimate and strengthen its biodiversity. Thus, trees and herbaceous plants are able to reduce dust, and the percentage of negative compounds influencing air pollution, such as nitrogen dioxide ($NO2$) [27]. Therefore, UA advances the cutback of the urban ecological impact by both sustainable waste management [28], and a decrease in emissions produced through transporting, storing, and packaging of goods, since the growing areas are located in the nearest areas to the final consumer [2].

Social aspects. On top of all, UA serves an important role in community-strengthening and integrating people with disadvantages or vulnerable social groups affected by stigmatization (e.g. elderly, disabled, immigrants, unemployed, etc.) into an

existing social context [29]. The urban gardening initiatives represent platforms for meeting new people, developing social networks, and sharing personal experiences empowering the individualities of each of their participants. Moreover, they are frequently associated with therapeutical qualities and educational possibilities provided through crop cultivation activities [30]. The last one is particularly beneficial for the youth and children as they receive an opportunity to receive first-hand agricultural knowledge on the traditional growing practices from the older generations and get complexly educated on environmental topics applicable in the future [31]. Pieces of evidence fixating the positive impact of UA on the elderly, youth, and children have been underlined in many recent research, demonstrating their improved mental and physical well-being through decreased self-isolation and increased physical activities [32].

Research aim. Although, the stated above theoretical information reveals various aspects of UA initiatives in greater detail, it lacks an actual connection with the practical implementation side of such projects. The absence of real-life explanatory experience of running analogous platforms creates a gap in perception of a common theory and ways of actual project establishment. Therefore, it becomes quite complicated to comprehend the design, operational components, and tools for founding UA activities, only possessing theoretical knowledge.

For this reason, the aim of this paper is to study the emergence conditions of UA initiatives on the real-life operated cases; understand what has influenced their establishment and lead to the formation of such structures; and underpin collected information with the analysis of consequently implemented practices and their constituents. By means of this, the author seeks to uncover the true nature of origin and functioning elements of realised UA platforms to form a better understanding of planning objectives and design recommendations.

Materials and method

The applied methodology of the research was used as a tool for identifying common planning traits of the UA initiatives which would help the future generation of landscape planners with the successful implementation of related projects in the requested settings. For this, the comparative analysis of studied UA practices had been carried out (See Table 1).

In total, 9 international UA projects, predominantly functioning by means of container gardening, were chosen. Such preference was predisposed by the universality of such cultivation method and complete applicability of its objectives regardless of any type of urban environment it can be placed in.

The aspects of project comparison. Based on the most fundamental constituents of a project initiation, the following points of interest have been selected for analysing:

- Location – to form a basic understanding of geographical, demographical, historical, cultural, governmental, and economic aspects of the project.
- Placement – to study the growing and general surrounding environment, its routes of exposure.
- Years of existing – to study year of initiation and project longevity.
- Area – to determine the size of the projected environment and its physical limits for planning.
- Purpose – to identify the goals and aims of the projects and ways of their positive effect on surroundings.
- Target users – to understand who the audience is, what are they looking for in that place, and how it should be planned in accordance with their needs.
- Capacity – to define actual production power of the place based on available area of growing, or a number of growing units.
- Financing – to specify what type of financing is provided to the place, who are figurative bodies in the monetary terms of place functioning.
- Growing medium – to understand what can be used to grow the production and to which extent.
- Grown products – to clarify what greenery can be grown, which cultivation options are the most efficient.
- Additional facilities – to define what type of additional construction units could be implemented at the place.
- Apiculture – to understand to which extent apiculture applied in the relevant practices and considered as an essential supplement to a garden.
- Compost – to determine if composting system is presented in the garden environment, and what supportive role does it serve in the place functioning.

Case studies

Prinzessinnengärten, Berlin.

The Prinzessinnengärten is a mobile community garden located in Moritzplats in Kreuzberg district, Berlin. It is a former wasteland area previously abandoned and polluted for over half a century that has been converted into a community garden by local residents. The garden has been active since 2009, and throughout this time the area has been rented annually from the city municipality. The Prinzessinnengärten is run by the non-profit organization Nomadisch Grün [33]. The beds for growing are made out of containers taken from the food sector, recycled baker's boxes, tetra packs, and rice sack. The territory also hosts workshop and storage facilities, located in disused and converted shipping containers, playing facilities for children, farmer markets, and since 2011 a seasonal garden cafe [34]. Nobody owns their own beds at the Prinzessinnengarten. The main amount of people is involved voluntarily in garden activities with the aim of sustaining the place. The public grows all kinds of

herbs and vegetables, more commonly turnips, carrots, parsnips, kale, Red Russian kale, radishes, fennel, basil, tarragon, sage, thyme, lovage, salad burnet, sorrel, chard, orache, charlock mustard, and purslane. The aim of this project is to convert open spaces into productive green landscapes where you can learn and try new things together with your community [35].

Gemeinschaftsgarten Tempelhofer Feld, Berlin. The Tempelhof Field is a park and recreational area located on the site of the former Tempelhof airport in the Berlin district of Neukölln. It is the largest inner-city open space in the world that hosts altogether 19 activities, like gardening, skating, strolling, and kite-surfing. With its microclimate and placement, Tempelhofer Field is also a refuge for many local species of plants and animals [36]. The history of the Tempelhof field is complex and eventful. Since the 18th century, the territory was used as arable land by farmers, a military parade ground and training area for the Prussian army, and even as an airport during Second World War times up to 2008 [37]. In 2011, the Berlin-wide network Allmende Kontor came to Tempelhof Field to construct the first 10 raised beds with around 20 people on an area of 5000 square meters. Since then, the gardener's community has expanded to over 500 people which created more than 250 container beds in a self-organized manner. The community garden has been self-supporting since 2014 by its own association and survives on voluntary donations that help to pay an annual fee of 5000€ to cover purchases of working materials, water supply, and other administrational costs [38].

Tradgard pa Sparet, Stockholm. Tradgard pa Sparet, or Garden on the Track, is one of the biggest non-profit garden associations located in Sweden [39]. The name was received due to the special placement of the garden – an old, abandoned train track area which was turned into a green and vibrant place inside the city. The garden consists of wooden pallets and containers that are used for growing food where some of them have individual sponsors and owners, and some belong to the community as a whole. During the summer weekend, a small cafe and outdoor scene operate at the place, allowing visitors to have coffee and socialize with others in the process of cultivation [40]. Tradgard pa Sparet has flexible rules for its members what makes urban gardening more accessible and easier for people to get involved in it. The aim of this project is to create, first of all, a social platform for everyone, so participants can learn about growing food and experience the full process of cultivation. As an instance, a special section of it is provided only for children and was made as a collaboration with schools in the local area to teach youngsters about natural processes [41].

Hell's Kitchen Farm Project, Manhattan, New York. Hell's Kitchen Farm Project (HKFP) is an urban rooftop farm located on the fifth floor of Metro Baptist Church. It took a challenge of addressing an issue of nutritional security, especially the scarcity of affordable fresh produce local residents faced in recent years. The garden was created 10 years ago by merging of four neighbourhood organizations, – a housing development company, a metro ministry, and church communities that decided to band together against the common problem. The farm operates on 370 square meters with the 100 sq m gained from the raised beds. As a growing medium, organizers choose kiddie pools with drilled drainage holes due to the weight factor that the old structure of the church roof can hold. The most popularly grown crops presented at the farm are basil, beans, blueberries, cabbage, collard greens, chives, cucumbers, eggplants, garlic, kale, lettuce, oregano, peas, peppers, potatoes, radishes, rosemary, scallions, and tomatoes. All produce from the farm goes directly to the local food pantries and charity organizations where the food got distributed between the community and people in need. However, the mission of the farm also states for youth education, so together with local school programs, HKFP offers internship places and yearlong studying programs for youngsters that focus on studying growing systems, the complexity of UA, and healthy life-style cultivation [42].

Food From The Sky, London. Food from the Sky was the first rooftop food growth and educational project located in North London from 2010 till 2014 [43]. The aim of this project was to create a permacultural community garden that would sell grown food in the supermarket below while providing learning space for the community upstairs. In this way, the farm could correspond both to commercial and educational-social criteria. The grocery store began its collaboration with the project leader Azul-Valerie Thome with only 10 tons of compost and 300 recycling growing boxes but with the time and help of volunteers, the garden was able to supply freshly harvested food to the supermarket on the regular basis [44]. Among the crops that had been grown were vegetables, fruits, mushrooms, and herbs, all cultivated following organic standards with the local community. Any fruits or vegetables that weren't sold, became a part of the compost programme for sharing and enhancing the soil for the next season of produce. Besides the main activity of the project, throughout the four years of its functioning, it ran a training programme and foundation course on food growing, biodiversity, and living a sustainable life which was called Seed2seed [45].

The Jonathan Club, Farmscape, Down-town LA. The Jonathan Club is a commercial UA project located in Downtown LA, established for the on-site restaurant by Farmscape company. Farmscape is one of the largest UA firms in the US that design, install, and maintain hundreds of farms across the state. Its aim is to create gardens that will connect people to a fresh, local source of food right in their neighbourhoods with

a focus on low-water management and sustainable landscaping [46]. Farmscape has collaborated with the Jonathan Club rooftop farm for nearly a decade. The farm occupies around 300 square meters of the roof space and consists of 56 stock tank planters, nearly 300 citrus trees, passionfruit vines, and blueberries, and a greenhouse that supplies the restaurant with the food cultivated in the shadiest corners of the space Additionally, to the direct benefits that the garden provides to owners, it also adds monetary value for the area attracting and bringing in new developers, building professionals, and government agencies [47].

Cadillac Urban Gardens on Merritt, Southwest Detroit. Cadillac Urban Gardens (CUGM) is a community garden project initiated by General Motors company that provided 250 shipping crates to the citizens of the district to turn them into the raised beds at the place of the former parking lot. The project is sponsored and supported through the collaboration of GM Supplier of the Year Ideal Group, and composting company Detroit Dirt [48]. The garden serves as a place for residents to meet, get access to fresh fruits and vegetables, share their knowledge, and exchange experience in growing. CUGM allows residence without private lands to do gardening, come and cultivate some produce which in turn leads to changes in their eating habits and builds a food security system for locals. On top of that, the garden community follows a zero waste philosophy. The majority of materials presented in the garden are reused, recycled, or upcycled. In this way, the garden's mission covers not only growing but rather cultivating community engagement, its health, and security, together with practicing environmentally sustainable management of the area [49].

Lewes Community Accessible Allotment, Brighton, UK. Lewes Community Accessible Allotment (LCAA) is a specially designed project for people with disabilities and younger members of relevant educational facilities. The design idea implied the creation of a growing space that could allow easy access for cultivation for individuals with different disabilities; promote growing opportunities starting from sowing a seed till harvesting ready produce for all; and provide a safe space/shelter with access to water and other utilities, potting area [50]. Landscape company Alitura, responsible for the design part, planned the garden with plenty of free space in order to provide easy access for people on wheelchairs and with mobility vehicles. Apart from this, to maximise the efficiency and functionality of the garden, Alitura placed plants with diverse forms and varieties. In this way, people with a greater diversity of disabilities could interact with greenery, e.g. on the vertical space of growing instead of horizontal. For a safer and more comfortable use of a wheelchair, designers brought wheel-friendly landscaping material made of Nidagravel units that cover all surfaces at the allotment.

[51]. LCAA is supported by many funders that deliver outdoor sessions and horticultural therapies. The whole plot is cultivated by its members, and grown produce is equally shared between all participants [50].

Sedona Winds Community Garden, Arizona, US. Sedona Winds Assisted Living (SWCA) is an accessible community garden designed for the elderly and disabled people. It was launched by local residents and volunteers headed by Ed Naylor, a former Lutheran pastor, just in four months period. All the construction and development works were accomplished in more than 500 hours with the help of participants, raised donations of over 15,000 dollars, and the charity support of local businesses [52]. The organization that stands behind the construction of the project, is called Gardens for Humanity. The garden project planned by them fully corresponds to all accessibility criteria and includes a main square for gardening, sheltered outdoor space with benches for the visitors, and wide walkways made out of pavers. As for the garden plaza, it was specially designed by means of raised containers with available space in the lower part for the people on wheelchairs, walkers, and scooters [52].

Conclusion and Recommendations

Following completion of the data table, the comparative analysis of studied urban agricultural practices had been carried out, and furthermore developed into the open concluding guidelines for the establishment of subsequent initiatives.

Location. Based on the conducted case study analysis, the general location of the projected UA initiative plays a crucial role in its further development. The experience of the implemented objects demonstrates a correlation between the scale of the city and the suitability of certain projects within them. Suchwise, a landscape architect should always keep in mind the relativity of causes and issues that are planned to be covered with agricultural platforms to the economical, ecological, cultural, and political state of things within the chosen city. Hence, the success and longevity of the project's existence will strongly depend on the total response received from the city residents and municipality. If the urban agricultural platform is intended to be realised as a private object, its positioning won't be necessary tied to certain locality parameters. As on the whole, this type of initiative is more secured due to the stable financial and administrative support from sponsoring structures (e.g. Lewes Community Accessible Allotment, Brighton, UK; Sedona Winds Community Garden, Arizona, US). Meanwhile, socially based public projects should be considered to be placed in a responsive and encouraging environment which could be open to acceptance of alternative green urban spaces. In a manner, to date, it is more reliable and effective to establish UA initiatives in the bigger cities with the wider range of issues to be covered (lack of open green

public spaces, immense presence of abandoned urban areas, nutrition deficiency of urban residents, etc.), and higher social/political/economical endorsement (availability of diverse urban planning/food policies within big cities municipalities, international grants, greater community feedback).

Placement. Once the location of a project had been chosen, its placement is set to be determined. In terms of it, as it was demonstrated by the case study, there are plenty of opportunities for the garden initiation, including open-soil direct cultivation and raised bed growing. The initiative can be placed in any available spot (e.g. rooftops, parking lots, former industrial facilities territories, etc.), thus the range of options is wide and flexible, allowing planners to adapt all kinds of urban areas for the gardening and needs of targeting audience. If a chosen territory doesn't have a history of pollution and presents opportunities for direct cultivation with open soil, then it could be instantly turned into the gardening green complex. Whether it has some level of soil contamination or features hard surface covering, the garden can be run by means of various upraised planting mediums. However, there are still some general rules to be followed while choosing a plot, such as: 1. Avoid settlement of gardens closer than 20 m from roads with heavy traffic due to the possibility of migrating heavy metal contamination; 2. Check spot for presence of invasive plant or animal species which could be a threat to the place; 3. Think about the minimal accessibility of water and light sources. 4. If the garden is placed on the rooftop, calculate maximum pressure the construction can hold. 5. Constantly cross-reference the purpose of the place and its targeting users with physical conditions the spot provides to make the greater choice.

Years of existing. As the data table indicates, the only place that got closed within the studied cases is Food from the Sky, London, UK. Nevertheless, the overall statistic of timewise functioning of UA initiatives is not so optimistic. This leads to another essential point – project lifetime. While cases discussed in the article present rather pioneering and unique events in UA history, most of the less well-known and smaller practices have been cancelled over time. The reasons for this outcome might vary but the most common is a matter of constant alteration of policies in terms of land leasing from the municipality (in case of public gardens), cancelling or premature ending of temporary social garden projects, and economical changes within countries of location [53; 54]. Therefore, the time factor should be reviewed on an equal basis with placement as it might influence the physical appearance of the gardens, their objectives, and ways of cultivation.

Area. While setting and determining parameters for the desired gardening territory, it is necessary to think about the area constituent and its sizing. Depending on the aims and targets of the projected initiative, one should understand which amount of land would be sufficient to use. The held case study reveals that small-scale projects associated mostly with recreational, therapeutic, or private commercial activities, can successfully and efficiently operate on 300-400 sq.m. Meanwhile, the ones oriented on larger-scale social involvement or production power, can reach up to 6000 sq.m. Whatever the case is, the primary establishment of such projects should always start from the smaller scales to ensure the full understanding of the gardens' capacity, cultivation ability, and functionality as a whole [55].

Purpose. As it was mentioned in previous conclusion blocks, the selected purpose of the place is closely linked to the following preferences picking for physical characteristics of the UA initiative. The objectives endowed to the place should strongly correspond to the general environment of placement and external request from society, municipality, or existing operational conditions of an area, to ensure the success and longevity of an initiative. Since the UA concept already includes social factors by its very nature, it is crucial to ascertain that a planned project can cover more than one bias and create a multi-functional environment for its users.

Target users. The factor of users is a key setting that planners should define before the start of a garden. When the purpose, placement, and area are set, it is essential to understand: who the audience is, what would they need at that place, and what functional distribution of areas would work for them in the best way possible. For that, if an area is public and open, and not limited by one specific category, it is useful to do a brief demographical analysis and overview of the existing educational, cultural, commercial, and residential places that could influence visitors, and following this, develop respective planning and relevant supporting facilities.

Capacity. According to the conducted case study table, it can be seen that garden capacity varies a lot depending on the area size, its usage, and functionality. There is no particular correlation between the amount of growing units/area and the total square of a garden what can be explained by varied prioritization of land usage.

Financing. The considered case study analysis indicates that each of the reviewed initiatives has varying financial sources of income, where approx. half of them fully depend on external support (donations from users, municipality, hosting organizations), and the other half runs inner commercial activities in order to sustain themselves. The interrelationship between ownership positions (private/public) hasn't been noticed. Although the projects existing under the protection of the public authorities which tend to be developed in a top-down approach, are inclined to have established financial backing from their sponsors. Meanwhile, bottom-up initiatives are confronted frequently by lack of funds what leads them to develop

TABLE 1

The comparative analysis of selected studied UA practices [created by authors]

Name	Prinz-essinnen gärten	Gemein-schaftsg arten	Tragard pa Sparet	HKFP	Food from the Sky	The Jona-than Club	CUGM	LCAA	SWCA
Location	Berlin, Ger-many	Berlin, Ger-many	Stock-holm, Sweden	New York, US	London, UK	Los An-geles, US	Detroit, US	Brighton, UK	Arizona, US
Placement	Former waste-land	Former airport	Former railway tracks	Church rooftop	Supermar-ket roof-top	Restau-rant rooftop	Former parking lot	Allot-ment gardens	Court-yard
Years	2009 - till now	2011 - till now	2012 - till now	2010 - till now	2010 - 2014	2013 - till now	2012 - till now	2015 - till now	2013 - till now
Area	6000 m2	5000 m2	n/a*	370 m2	n/a	300 m2	n/a	345 m2	n/a
Purpose	Social, environ-mental, educa-tional	Social, environ-mental	Social, educa-tional	Food se-curity, so-cial	Commer-cial, so-cial, edu-cational	Com-mercial	Social, environ-mental	Social, thera-peutical	Social, thera-peutical
Target Users	Middle - aged people	Middle-aged people, young families	Middle-aged people, children	n/a	n/a	n/a	Adults, families, children	People with dissabil-ities	Elderly, people with dissabil-ities
Capacity	>500 growing units	>250 growing units	>50 growing units	52 grow-ing units	>300 growing units	>50 growing units	>250 growing units	n/a	n/a
Financing	Inner com-mercial activi-ties	Volun-tary do-nations	External financial support	External financial support	Inner commer-cial activi-ties	Inner com-mercial activi-ties	External financial support	External financial support	External financial support
Growing Medium	Recy-cled food contain-ers	Raised wooden beds	Wooden pallets and con-tainers	Kiddie pools	Raised wooden beds	Stock tank planters	Ship-ping crates	Raised wooden beds for people with dissabil-ities	Raised wooden beds for people with dissabil-ities
Grown Products	Root veg., salads, herbs, ind. crops	Root veg., salads, herbs, ind. crops	Root veg., salads, herbs, ind. crops	Berries, herbs, cabbages, root veg., salads, beans, etc.	Vegeta-bles, fruits, mush-rooms, herbs	Vegeta-bles, salads, herbs, citruses, vine plants	Root veg., salads, herbs, ind. crops	Root veg., salads, herbs, ind. crops	Root veg., salads, herbs, ind. crops
Additional Facilities	Garden kitchen, tool storages	Tool storages	Garden cafe, green-house tunnel	Food pan-try	Green-houses	Green-house, restau-rant	Green-house tunnels	None	Shel-tered outdoor space
Apiculture	Yes	No	No	Yes	Yes	No	Yes	No	No
Compost	No	Yes	No	No	Yes	No	No	No	No

n/a* - not applicable

independent inner sources of funding (establishment of food markets and cafes, hosting of cultural activities, gardening workshops, etc.).

Growing medium. In regard to plant cultivation by means of modular raised beds or appropriate objects, the choice of mediums is greatly broad and unlimited. As demonstrated by studied practices, virtually any tank or container could be turned into the planting environment. If the budget of a garden is low or its objectives involve ecological education, upcycled food containers or shipping crates will do great, as far as they suit the physical characteristics of cultivating crops. This option also serves as a perfect opportunity for gardens to be mobile and flexible in terms of their structure and placement. Nonetheless, it is important to remember about accumulating contamination factor frequently occurring in the closed medium space and resulting in a high level of soil pollution over time.

Grown products. Referring to the cultivating crops selection, most of the studied cases have a similar growing assortment. As indicated in the summarizing table and confirmed by the experience of implemented UA projects, the most common and efficient cultivars for urban environment are: root vegetables (turnips, carrots, beets, etc.), salads (lettuce varieties: leaf lettuce, romaine, iceberg; spinach, chicory), herbs (basil, thyme, parsley, dill, etc.), and cabbages (bok choy, savoy, kale, cauliflower, etc.). There were partial cases of beans and mushroom farming, but they haven't been much popularized due to the more complicated nature of growing and required advanced cultivation settings. Comparing, turnip plant can mature in a month from the moment of direct seeding, carrots – 2 months, and lettuce – 1.5 months, what provides them with a great advantage in terms of crop rotation rate and simplicity of maintenance.

Additional facilities. The case study has demonstrated that the choice of additional garden facilities is rather an optional prospect strongly associated with the primary function of a farming platform and alleged time spent there. In this manner, there could be distinguished recommended primary constructions, such as tool sheds, sanitary cabins, sheltered outdoor spaces for meeting, and food pantries; and supplementary arising from the objective function, like greenhouse tunnels (with a need of cultivation extension), or garden kitchen/cafe/restaurants (for running commercial and cultural activities).

Apiculture. As it was stated in the analysis, apiculture as a separate activity has been observed only in half of the cases, which, remarkably, position themselves as ideologically organic or permacultural practices. However, this relationship might be additionally justified by the placement specifics of the mentioned projects and the difficulty of natural bee access to these areas. While some projects are located in places of relevant proximity to urban green zones or natural green areas, giving them the advantage of established availability of pollinators at the nearby territory, others can face a deficiency of bees and necessity of artificial involvement due to the harsh urban surroundings. Hence, in this case, beekeeping would be rather essential than just supplementary action, and should be followed for ensuring pollinating process within the garden and strengthening conserving environments for pollinators.

Compost. Same as apiculture, usage and presence of compost system were noted only in a minority of cases. The accurate correlation and link between composting system availability and an initiative is hard to determine but the appliance of compost itself was described in all practices. Meanwhile, the installation of the system can be unfeasible due to the area limitations or lack of administrative rights, the benefits of compost usage in gardens are undoubtful. Therefore, some urban farmers have established relationships with local composting factories for the supply and donation of organic matter. In this way, it is hard to conclude the actual necessity of composting system construction in each of the urban gardens with the present partnership options as stated above. However, if a planner has the possibility to include such a supporting structure within its project, it could assist a place significantly in terms of consequent advantages with organic waste recycling, soil enriching and rebuilding, and reducing a need for chemical fertilizers appliance.

Summary. The conducted case study could be used as a referring recommendation paper during the primary stages of UA initiative establishment. Together with a brief theoretical part, it might be served as a reasoned core for analysis and argumentation of newly designed environments by landscape architects and city planners. The overall characteristics and received examined results shall be projected on further settings carefully and in accordance with relevant socio-economic, environmental, and political backgrounds.

References
1. **Ruel, M. T., Garrett, J. L., Morris, S. S.,** et. al. Urban challenges to food and nutrition security: a review of food security, health, and caregiving in the cities (No. 583-2016-39546), 1998, p. 1-129.
2. **Ghosh, S.** Food production in cities. In International Conference on Urban Horticulture 643, 2002, p. 233-239.
3. **Drescher, A. W., Iaquinta, D.** Urban and peri-urban Agriculture: A new challenge for the UN Food and Agriculture Organisation (FAO). FAO, Rome, 1999.

4. **Viljoen, A., Bohn, K**. Continuous Productive Urban Landscapes: urban agriculture as an essential infrastructure. Urban Agriculture Magazine, (15), 2005, p. 34-36.
5. **Keshavarz, N., & Bell, S.** A history of urban gardens in Europe. In Urban allotment gardens in Europe, 2016, p. 30-54.
6. **Bischoff, A.** Greenways as vehicles for expression. Landscape and Urban Planning, 33(1-3), 1995, p. 317-325.
7. **Glover, T. D., Parry, D. C., Shinew, K. J.** Building relationships, accessing resources: Mobilizing social capital in community garden contexts. Journal of Leisure Research, 37(4), 2005, p. 450-474.
8. **Bell, S., Fox-Kämper, R., Keshavarz,** et. al. Urban allotment gardens in Europe. Routledge, 2016.
9. **Iles, J.** The social role of community farms and gardens in the city. Continuous productive urban landscapes: Designing urban agriculture for sustainable cities, ed. A. Viljoen, K. Bohn, and J. Howe, 2005, p. 82-88.
10. **Ghosh, S., Vanni, I., Giovanangeli, A.** Social aspects of institutional rooftop gardens. Green Roof Retrofit: Building Urban Resilience, 2016, p. 189-215.
11. **Benis, K., Ferrão, P.** Commercial farming within the urban built environment–Taking stock of an evolving field in northern countries. Global food security, 17, 2018, p. 30-37.
12. **Carolan, M.** "Urban Farming Is Going High Tech" Digital Urban Agriculture's Links to Gentrification and Land Use. Journal of the American Planning Association, 86(1), 2020, p. 47-59.
13. **Santo, R., Palmer, A., Kim, B.** Vacant lots to vibrant plots: A review of the benefits and limitations of urban agriculture. John Hopkins center for a Livable Future, May, 2016.
14. **Orsini, F., Kahane, R., Nono-Womdim,** et. al. Urban agriculture in the developing world: a review. Agronomy for sustainable development, 33(4), 2013, p. 695-720.
15. **Maxwell, D., Levin, C., Csete, J**. Does urban agriculture help prevent malnutrition? Evidence from Kampala. Food policy, 23(5), 1998, p. 411-424.
16. **Smith, I. F., Eyzaguirre, P.** African Leafy Vegetables: their role in the World Health Organization's Global Fruit and Vegetables. Afr J Food Agr Nutr; Vol 7, No. 3, 2007.
17. **Zezza, A., Tasciotti, L.** Urban agriculture, poverty, and food security: Empirical evidence from a sample of developing countries. Food policy, 35(4), 2010, p. 265-273.
18. **Egal, F., Valstar, A., Meershoek, S.** Urban agriculture, household food security and nutrition in Southern Africa. Proceedings, Sub-Regional Expert Consultation on the Use of Low Cost and Simple Technologies for Crop Diversification by Small Scale Farmers in Urban and Peri-Urban Areas of Southern Africa, University of Stellenbosch, Stellenbosch, 2001, p. 143 - 147.
19. **Orsini, F., Michelon, N., Scocozza, F.,** et. al. Farmers-to-consumers: an example of sustainable soilless horticulture in urban and peri-urban areas. In International Symposium on the Socio-Economic Impact of Modern Vegetable Production Technology in Tropical Asia 809, 2008, p. 209-220.
20. **Redwood, M.** Agriculture in urban planning: generating livelihoods and food security. Routledge, 2012.
21. **Agbonlahor, M. U., Momoh, S., Dipeolu, A. O.** Urban vegetable crop production and production efficiency. International journal of vegetable science, 13(2), 2007, p. 63-72.
22. **Garnett, T.** Urban agriculture in London: rethinking our food economy. Growing Cities, Growing Food. German Foundation for International Development, Feldafing, Germany, 2000, p. 477-500.
23. **Protocol, G. H. G.** Greenhouse gas protocol for cities, global standard for measuring greenhouse gas emissions, 2015.
24. **Guerrero, L. A., Maas, G., Hogland, W**. Solid waste management challenges for cities in developing countries. Waste management, 33(1), 2013, p. 220-232.
25. **Smit, J., Nasr, J., Ratta, A.** Urban agriculture: food, jobs and sustainable cities. New York, USA, 2, 1996, p. 35-37.
26. **Cofie, O., Bradford, A., Drechsel, P.** Recycling of urban organic waste for urban agriculture. Cities farming for the future: Urban agriculture for green and productive cities, 2006, p. 210-229.
27. **Harris, T. B.** Nitrogen Dioxide in the Urban Forest: Exposure and Uptake, 2010.
28. **Coffey, M., Coad, A.** Collection of municipal solid waste in developing countries. UN-Habitat, United Nations Human Settlements Programme, 2010.
29. **Novo, M. G., Murphy, C.** Urban agriculture in the city of Havana: A popular response to a crisis. Bakker N., Dubbeling M., Gündel S., Sabel-Koshella U., de Zeeuw H. Growing cities, growing food. Urban agriculture on the policy agenda. Feldafing, Germany: Zentralstelle für Ernährung und Landwirtschaft (ZEL), 2000, p. 329-346.
30. **Smit, J., Bailkey, M., Van Veenhuizen, R.** Urban agriculture and the building of communities. Van Veenhuizen, R. Cities farming for the future, urban agriculture for green and productive cities. Leusden: RUAF Foundation, 2006, p. 146-171.
31. **Mezzetti, M., Orsini, F., Fecondini,** et. al. Women and simplified hydroponics: community gardening as a way of emancipation in Trujillo, Peru. In II International Conference on Landscape and Urban Horticulture 881, 2009, p. 169-172.
32. **Othman, N., Mohamad, M., Latip, R. A.,** et. al. Urban farming activity towards sustainable wellbeing of urban dwellers. In IOP Conference Series: Earth and Environmental Science (Vol. 117, No. 1, p. 012007). IOP Publishing, 2018.
33. **Prinzessinnengarten**. Über Uns. [online 20.09.20.]. https://prinzessinnengarten.net/
34. **Clausen, M.** Urban agriculture between pioneer use and urban land grabbing: The case of "Prinzessinnengarten" Berlin. Cities and the Environment (CATE), 8(2), 2015, p. 15.
35. **Wulff, G.** Collective Counter Cartography from Prinzessinnengarten, Berlin. disClosure: A Journal of Social Theory, 23(1), 2104, p. 6.
36. **Grun Berlin Gruppe**. Tempelhofer Feld. [online 20.09.20.]. https://gruen-berlin.de/en/tempelhofer-feld/about-the-park
37. **Tempelhof Projekt**. Location information. [online 20.09.20.]. https://www.thf-berlin.de/en/location-information /tempelhof-field/

38. **Allmende Kontor.** Gemeinschaftsgarten. [online 20.09.20.]. http://www.allmende-kontor.de/
39. **Trädgårds Sverige**. Trädgård på Spåret, Stockholm. [online 20.09.20.]. https://www.tradgardssverige. org/tradgardar/tradgard-pa-sparet/
40. **Axfoundation.** Trädgård på Spåret – urban odling. [online 20.09.20.]. https://www.axfoundation.se/projekt/urban-odling-ar-vi-pa-ratt-spar
41. **Towards the Human City.** Garden on the Track Stockholm, Sweden. [online 20.09.20.]. https://towards thehumancity.org/initiative-86-garden-on-the-track-stockholm-sweden
42. **Garden Collage.** Inside Hell's Kitchen Farm Project. [online 21.09.20.]. https://gardencollage.com/nourish/farm-to-table/inside-hells-kitchen-farm-project-urban-rooftop-unexpected-twist/
43. **Food from the Sky.** Our growing vision. [online 21.09.20.]. https://foodfromthesky.wordpress.com/
44. **The Guardian.** The supermarket growing food on its roof. [online 21.09.20.]. https://www.theguardian. com/environment/2011/mar/09/supermarket-rooftop-vegetable-garden
45. **Food from the Sky.** Seed2seed. [online 21.09.20.]. https://foodfromthesky.org.uk/
46. **Ubique**. Farmscape: Urban farming. [online 21.09.20.]. https://ubique.americangeo.org/company-and-not-for-profit-spotlights/farmscape-urban-farming/
47. **Farmscape.** The Jonathan Club. [online 21.09.20.]. https://farmscapegardens.com/project/the-jonathan-club/
48. **SDEV.** Cadillac Urban Gardens. [online 21.09.20.]. https://www.sdevweb.org/our-urban-gardens/cadilac-urban-gardens
49. **General Motors.** GM Opens Community Urban Garden in SouthwestDetroit. [online 21.09.20.]. https://media.gm.com/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2012/Aug/0801_urbangarden.html
50. **Common Cause.** Lewes Community Allotment. [online 21.09.20.]. http://www.commoncause.org.uk/lewes-community-allotment
51. **Allitura**. Accessible Allotment. [online 21.09.20.]. https://alitura.co.uk.archived.website/projects/garden-design-accessible-allotment/index.html
52. **Gardens for Humanity.** Sedona Winds Assisted Living Accessible Healing Garden. [online 21.09.20.]. https://gardensforhumanity.org/sedona-winds-wheelchair-accessible-garden/
53. **Klaassen, M., NoorderRuimte, B.** Urban Farming at Zernike, 2013.
54. **Calvet-Mir, L., March, H.** Crisis and post-crisis urban gardening initiatives from a Southern European perspective: The case of Barcelona. European Urban and Regional Studies, 26(1), 2019, p. 97-112.
55. **Stone, C.** The urban farmer: Growing food for profit on leased and borrowed land. New Society Publishers, 2015.

AUTHORS:

Dorofieieva Kateryna, B. Arch 'Urban planning', Lviv Polytechnic National University; B. Eng 'Landscape Architecture and Planning', Latvia University of Life Sciences and Technologies; former intern in 'Botildenborg' – social urban agriculture platform, Malmö, Sweden. Currently in Ukraine, independently practicing in Landscape Architecture, and researching Urban Agriculture opportunities for physical and mental rehabilitation for people affected by armed conflict. E–mail: kathrinamber@gmail.com, phone: +380953518358.

Kristīne Vugule, Dr. arch., associate professor and leading researcher at the Department of Landscape Architecture and Planning, Faculty of Environment and Civil Engineering, Latvia University of Life Sciences and Technolgies. E–mail: kristine.vugule@llu.lv

Kopsavilkums. Pasaules straujā izaugsme un attīstība ir novedusi pie būtiskām izmaiņām pilsētu izplešanās procesos, zemes sadalījumā un mūsdienu pilsētu vispārējā funkcionēšanas modelī. Problēmas, kas saistītas ar ekoloģiju, ekonomiku, cilvēku fizisko un garīgo labklājību, ar katru dienu kļūst arvien aktuālākas, jo rodas atvērtu zaļo zonu trūkums, uztura drošība un ilgtspējīgi finanšu modeļi mazajiem uzņēmumiem pilsētās; un ietekmē ne tikai parastos iedzīvotājus, bet arī vispārējās pilsētu un ainavu plānošanas tendences, kurām vajadzētu risināt konkrētos jautājumus. Viens no instrumentiem cīņai pret tiem pēdējās desmitgadēs ir kļuvis arvien populārāks pilsētu lauksaimniecība, kas īpaši izvēlēta kā šīs publikācijas interesējošais objekts. Raksts atspoguļo komplekss pētījumus, kas veikti integrētā veidā, pārskatot pilsētu lauksaimniecības vispārējo parādību un tās novatorisko praksi; nosakot to veiksmīgas darbības galvenos komponentus un pozitīvus veidus, kā ietekmēt apkārtni; un līdz ar to veidojot noslēguma ieteikumu sarakstu šādu struktūru plānošanai un pārvaldībai. Kā galvenās izpētes metodes autores izmantoja selektīvo gadījumu izpēti, kurā aprakstītas galvenās iezīmes, literatūras analīze pamatinformācijas apkopošanai. Pētījuma rezultāti tika apkopoti kopsavilkuma tabulā, kurā uzsvērti pamatdati un atbalstīts izstrādātais secinājums, kas balstīts uz pārbaudi un ieteikuma izstrādi ieinteresētajām personām.