

Review

Modernist Projects of Community-Based Urban Farms in Residential Areas—A Review of Agrarian Cooperatives in the Context of Contemporary Urban Development

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Abstract: This paper concerns the issue of food systems in the context of urban development. It describes relevant residential area ideas that integrate cities with food production, such as agrarian cooperatives. In the first section, modernist projects of residential areas linked with urban farms are reviewed, considering cooperative movement and the Industrial Revolution. This review shows that the aim of these historical projects was self-sufficiency and sustainability, based on local food production and broad areas covered by vegetation. They are considered to be a contemporary residential model. The second part of the paper discusses contemporary projects of farms within estates. The study demonstrates that the production of goods under urban agriculture goes beyond private goods, such as food produced for market or own use. The examples discussed show that urban farming performs key functions in residential architecture.

Keywords: urban agriculture; agricultural urbanism; low-density urbanism; communal space; sustainability



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1. Introduction

1.1. Background

Urban agriculture (UA) has become a commonly discussed topic in recent years with regard to sustainable development [1–3]. Various multidisciplinary studies have clearly indicated the positive impact of UA in social, ecological, and economical areas [4–13]. It is worth noting that this impact is variable depending on the geopolitical context. The largest differences are generally seen between the countries of the Global South and the Global North, or between cities in which agriculture was introduced for purely pragmatic reasons, i.e., lack of food and presence of poverty, and cities in which agriculture, or more commonly horticulture, was used to create sites attractive for the local society [14]. Furthermore, effects desirable in one of these areas may lead to negative consequences in other areas, as in the gentrification process caused by the development of neighborhood gardens [15]. Therefore, the issue is not unambiguous, and the real, overall impact of UA depends on the policy of local governments and spatial solutions.

Nevertheless, the idea of UA, as an emblem of a “healthy habitat” [16,17], is now more commonly present in the development plans for cities of the Global North (e.g., Foodshift 2030) [18–20]. UA has become an essential component of the urban-architectural concept, and is significant in social, ecological, economical, and spatial aspects (e.g., in the European 15 competition) [21].

The first UA concepts, being a response to the industrialization process in the 19th century, were part of cooperative projects formed in the framework of cooperative movement. They are referred to as agrarian cooperatives herein, because their main aim was self-sufficiency achieved by communal areas used for food production designed in the vicinity of residential buildings. In such projects, residential and service buildings are surrounded by green areas with agrarian and recreational functions [22–24]. At the same

time, the idea of city decentralization was also developed, followed by, at the beginning of the 20th century, the agrarian urbanism concept [25]. In effect, projects of decentralized urban–rural hybrids were implemented [26,27].

Due to low intensity of development and low population density per square kilometer, the agrarian cooperatives discussed in this paper, in addition to the concepts of cities in the agrarian urbanism mainstream, are referred to as low-density urbanism [28,29]. According to numerous authors, in contrast to high-density cities, such low-density urbanism is the basis of sustainable development [30,31].

Following the argumentation in which fast development (also of cities) is assumed to be non-sustainable, due to being accompanied by the rapid exploitation of finite natural resources and, thus, a lack of time for the regeneration of natural areas [30,31], the concept of low-density urbanism is discussed herein, particularly during climate change.

1.2. Aim of the Study

The main goal of this paper is to review architecture and landscape architecture projects that integrate cities with food production. The study discusses the concept of UA architecture and agricultural urbanism, in particular, the modernistic projects of agrarian cooperatives and community-based urban farms as their contemporary continuation.

1.3. Methods

Previous studies on this topic have been undertaken in multiple forms, including: project documentations, architects' studies, contemporary academic papers, professional reports, and websites, as demonstrated in this paper's references. Selected urban agriculture objects were analyzed based on: architectural drawings, original descriptions, and critical texts, in addition to specialist articles on gardening, and websites managed by community gardens and founding groups of urban farms. The current review examines a wide range of literature related to urban agriculture, architecture, and urban design, in addition to cooperativism. A portion of the descriptions and analyses were prepared during on-site visits.

2. Agrarian Cooperatives

The consequences of the first Industrial Revolution included changes in social organization and urban scale [32]. Relatively fast population growth in European metropolitan areas generated housing and food supply problems. Due to progressive development and shrinking of biologically active areas in cities, the following have become crucial issues: access to green areas for city dwellers, sufficient insolation and urban ventilation, and communal waste management [33,34]. Therefore, during the industrial era, new spatial strategies began to be sought for rapidly growing cities, and food supply for their citizens became a key problem.

As early as the 1820s, Charles Fourier designed an ideal city—the phalanstery (Fr. *phalanstère*)—which transformed his concept of a social system into an architectural project. Fourier proposed an autarkic city for 18,000 citizens, in which organized, cooperative housing is interconnected with rural areas. In this project, the city is situated in a building—a horizontal palace edifice—encompassing various utility rooms, such as stables, granaries, and workshops. Although Fourier designed a communal object, he intentionally drew inspiration from palace architecture (e.g., the Louvre), which he emphasized by calling the edifice the “Palace” [22,35].

A courtyard was designed in the front of the palace, and the entire area was surrounded by arable land (Figure 1), where food is produced in volumes sufficient for the needs of the entire population of this agrarian cooperative. Furthermore, Fourier implemented his contemporary practices in agriculture, such as field division and monoculture farming. In turn, he proposed agriculture diversification and variable, interchanging tillage types, which would form a polyculture-type ecosystem [22].



Figure 1. View of the phalanstery (lithograph by Fugère H.), (Fugère H., *Vue d'un phalanstère, village français [composé] d'après la théorie sociétaire de Ch. Fourier*, date uncertain, but from 19th century. Soc 860.05, Houghton Library, Harvard University).

The phalanstery concept inspired the Russian geographer Piotr Kropotkin, who also searched for solutions to contemporary spatial problems, namely, expansion of cities and depopulation of villages, in addition to social problems, such as difficult working conditions and the poverty of the working class. In 1888, Piotr Kropotkin described the concept of autonomous and self-sufficient villages, in which the housing function was coupled with industry and farming [36]. This was a concept of “the village of the future” with urban functions. The definition of a city may be elaborated with regard to: (a) demography—in which cities are areas with high population density; or (b) function—in which cities are areas with activities related to social-political functions, and with organizations and institutions of a wide range of influence [28]. The second definition also includes areas characterized as “low-density urbanism” [30]. These urban social-political activities were also planned in Kropotkin’s “village of the future”. Furthermore, it was planned to be managed by a cooperative of citizens, and all its members would interchangeably work in industry or agriculture depending on the production requirements and seasons [36]. An example of such an agrarian cooperative was the short-lived Clousden Hill Colony near Newcastle in England [37].

The basic assumption of the cooperative movement is the rule that natural resources are managed by, and the final products belong to, all members of the cooperative. Ebenezer Howard, when devising his garden city concept, tried to apply this rule to a larger urban society. The basic garden city principles include organized population migration, a cooperative system of land ownership, and a plan of a concentric city surrounded by farmlands [23].

Howard’s project was composed of individual autonomous garden cities, i.e., “satellites” of a larger city, of which each was intended for about 32,000 citizens [23]. In this project, urban and rural zones maintain a production–consumption ratio that guarantees self-sufficiency of particular garden cities. Various forms of agriculture were planned, e.g., farmlands between the “satellite” garden cities, and homestead gardens interweaving with the urban fabric. Farming was intended to be entirely local, based on direct contact with producers and consumers, with “intelligent circulation”, i.e., the use of organic waste to fertilize arable fields was also planned [23].

The basis of this concept is a cooperative city model. Therefore, the author began to propagate his ideas by approaching the existing cooperative communities to invite their members to participate in the establishment of garden cities. Thus, the newly formed city

would be a place of activity of a particular cooperative with organizational experience [23]. This is how the Garden City Movement began.

In the beginning of the 20th century, two garden cities were established in Great Britain—the Letchworth Garden City and the Welwyn Garden City; neither of these, however, fully realized Howard’s concept of a self-sufficient urban–rural hybrid, belonging to a cooperative [38]. Nevertheless, this concept played a crucial role in shaping the structure of present-day cities, and particularly the appearance of garden estates.

At the same time, the concept of community smallholder spaces was vigorously developed in cities, i.e., allotments in Europe, and, since the First World War, community gardens in the USA [39]. The first allotment gardens appeared in England, beyond urban areas, in 1795–1834 [40,41]. In 1820, the first allotments (Ger. *Kleingärten*) appeared in the German Confederation as gardens for the unemployed in Kiel [42].

One of the most interesting architects of residential areas with vegetable gardens was Leberecht Migge. In 1919, he published a project of a self-sustainable working-class residential area with arable lots for each citizen (Ger. *Siedlung*). The housing estate comprised multi-family or single-family terrace houses not exceeding three stories. A garden allotment situated behind the building or in close vicinity was ascribed to each housing unit (Figures 2 and 3). The residential area was supposed to maintain the character of a self-sustainable unit with a closed production–consumption cycle. In addition to individual tillage allotments, larger areas of communal farmlands were also planned [24]. Leberecht Migge, inspired by Kropotkin and the cooperative movement, also assumed a cooperative character of management in the estate, in which the land and agricultural products were intended to belong to the community [24,37]. In a manifest published in 1919 [43], he proclaimed social support by establishing the largest possible number of vegetable gardens in the Weimar Republic, so that each citizen was able to ensure food for himself and his family [44].

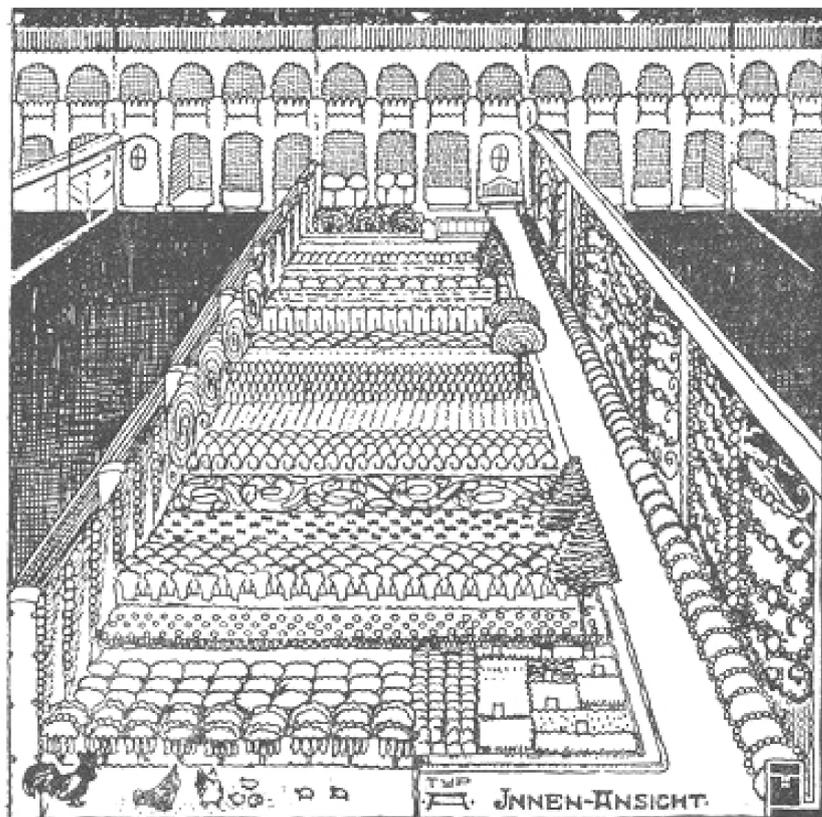


Figure 2. View of a vegetable garden situated behind the residential building (Germ. *Siedlung*, by Migge L., 1919), Leberecht Migge, 1919b, p. 36).

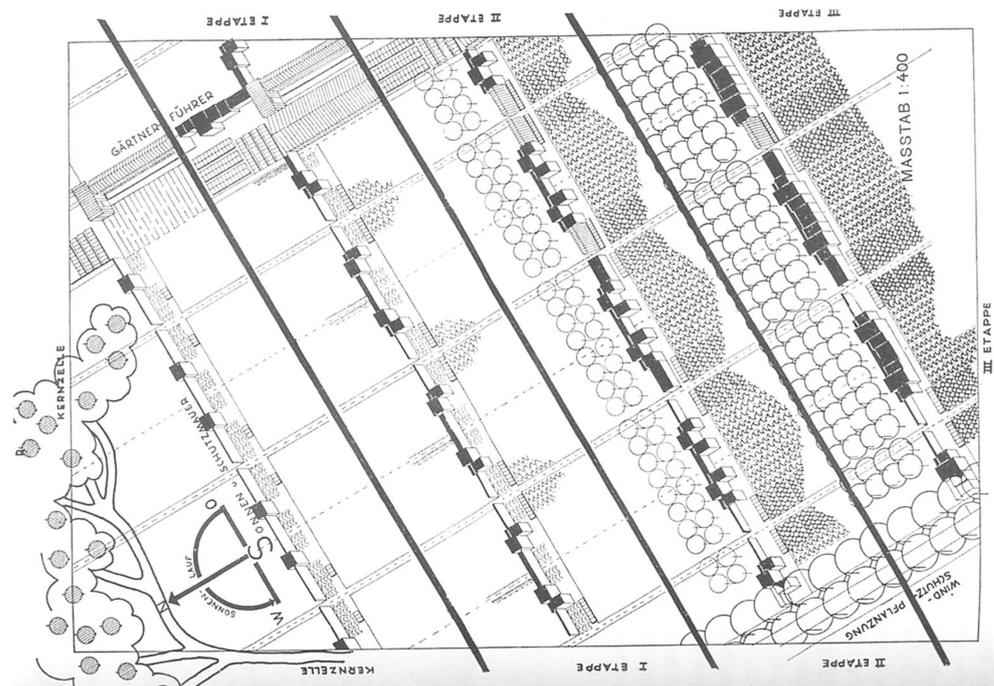


Figure 3. Diagram showing the stages of development of the self-sufficient residential area (Germ. *Siedlung*, by Migge L.), (Leberecht Migge, 1932, p. 23).

Before the Second World War, the idea of a self-sustainable residential area was implemented in a small number of German cities. Following the plans of Migge, the Hof Hammer Siedlung began to be constructed in Kiel. In this project, the architect designed various types of housing units: some with large gardens, for commercial production of food, and others with smaller lots, for families growing edible plants for individual use. Migge assumed that, due to agriculture, the colony would be economically self-sustainable. This, however, was not achieved, because most inhabitants were engaged in other jobs, with gardening being solely an additional and recreational activity [37]. The concept was also partially achieved in 1926–1929 in the Ziebigk estate in Dessau, and in the Teller estate, which is part of the Neue Frankfurt foundation, from 1925–1930 [37].

From a functional perspective, Le Corbusier similarly designed a housing estate in the Ville Contemporaine (1922). He anticipated three types of housing development in his urban project: point multi-story buildings on a cruciform plan, 10- or 12-story buildings in the form of closed blocks (surrounding a lot), or belt-like buildings across the lot [45]. The latter also occurred in a lower version as six-story buildings in the precincts of the Ville Contemporaine, in a residential area that Le Corbusier called a “garden city”. The architect planned space for food production for the dwellers and took the term “garden city” from Howard. He did not, however, copy Howard’s spatial solutions. On the contrary, he was critical of the idea and of garden colonies corresponding in style to rural architecture [45].

Corbusier’s garden city district is an alternative for the suburbs with single family houses, in which the architect proposes connecting individual houses into a multi-family development [45]. The design includes a repetitive modulus: two-level apartments open onto two elevations, i.e., cut out across the block (this is the basic residential unit, the prototype of which was realized in 1925 in the form of the L’Esprit Nouveau pavilion). In addition to individual terrace gardens, the project includes a common farm, i.e., a farmland with an area of 4 ha. The agrarian lot was separated from the buildings by a belt of common orchard. However, a hired farmer, rather than the inhabitants, would be responsible for the farm work. Originally, the estate was designed to be self-sufficient in terms of food production [45].

In the Ville Contemporaine concept, agriculture plays a small role and the space for farmlands was planned only in the above-described garden city estate. However, in the later years of his activity, Le Corbusier turned from technocratic design to regionalism. His interest in ruralism was linked with becoming engaged in the “neo-syndicalist” movement from 1930; he developed its variety; that is, the so-called regional syndicalism. At that time, Le Corbusier made friends with the peasant activist Norbert Bézard, who asked him to design a modern village and farm [46].

In 1935, Le Corbusier presented the project of the Ville Radieuse, an amended and more radical version of the Ville Contemporaine, in which he linked urbanism with ruralism. The author stated that “the village is the city of tomorrow” [47] (p. 165). The new project assumed that a village is located in close proximity of the city, and connected to it with a highway. The Village Radieuse is a unit of an agricultural cooperative, comprising two zones: a residential-administrative zone and a production-storage zone [47,48]. In this project, rural architecture is standardized, comprising prefabricated elements, and looks exactly like modernistic urban architecture.

The architect and farmer presented this cooperative concept in 1930 in an unpublished manuscript entitled “La Ferme radieuse et le centre coopératif”. A publication with sketches of a modern village with the Ferme Radieuse appeared in 1938 [49,50]. The agricultural cooperative was never built.

The agrarian function was introduced more radically in later modernistic urban projects. The idea of agrarian urbanism—a holistic approach to connecting urban areas with areas of food production—is a continuation of garden cities and self-sustainable estates. Agrarian urbanism fully occurred in the 20th century concepts of city models [25], such as the Broadacre of Frank Lloyd Wright [51] and the New Regional Pattern of Ludwig Hilberseimer [26].

3. Contemporary Communal Urban Farms

It was commonly assumed that urban agriculture would disappear with industrialization. This, however, has not been the case and, after many years of pushing agriculture towards city peripheries (metaphorically and literally), the topic has returned [14], mainly due to aforementioned economic, ecological, social, and spatial functions [2,52–55].

Collective farms in urban residential areas are a type of contemporary UA, being closest to the idea of an agrarian cooperative. In comparison to community gardens, these farms primarily have a productive character. Their area is maximally used for tillage of edible plants, and the recreational-leisure function occurs slightly or not at all.

Contemporary examples of estate farms are the AgroCité (2014) in Paris, the MUFi (2011) in Detroit, and the Urby Staten Island (2016) in New York. The first two are managed by the local community. The AgroCité farm was developed during the R-Urban project conducted by the architectural studio Atelier d’Architecture Autogérée (AAA) between 2010 and 2014 [56]. The project included studies on the cooperation strategies between grassroots initiatives related to organic and urban agriculture. The AgroCité farm was established on vacant lots in the urban quarter of the Colombes district in Paris (Figures 4 and 5) [57]. Between March and April 2018, the AgroCité farm was shifted to a lot located in the neighboring district of Paris, i.e., Gennevilliers.

The MUFi farm, located in a suburb of Detroit, was founded by the Michigan Urban Farming Initiative (MUFi), and then given to the local residents who cultivate it for self-supply, with surplus production donated to food banks [58]. The farm covers vacant lots between single-family dwellings. Its total area, of about 5000 m², covers two rectangular plots located opposite each other on two sides of a street.



Figure 4. Location of the *AgroCité* farm in the Colombes district in Paris, before relocation [original study, based on: www.google.pl/maps, (accessed on 16 August 2018)].



Figure 5. View of *AgroCité* in front of the residential area in the Colombes district in Paris, before relocation (project by AAA studio, 2010–2014), (photo by author, 2016).

The farm in the Urby Staten Island estate in New York has a different character. The farmer is an employed person who, in addition to a salary, is provided with a house in the estate [59]. The crops can be used by the citizens and a coffee shop located in the ground floor of the building, whereas the surplus production is sold [60]. Thus, the arable land is part of the residential area, like in Le Corbusier’s garden estate. The residential complex comprises four cuboid buildings arranged in the shape of the letter “E”. The farm (with an area of approx. 1500 m²) is located in one part of the courtyard. It contains a greenhouse, composter, communal kitchen, and a dining room. In addition, there is an apiary with beehives on the roof of the building.

The primary purpose of urban farming is providing city inhabitants with access to fresh fruit and vegetables. Thus, local food production is particularly important in crisis situations, as exemplified by the Victory Gardens during the World Wars [39,42,61], and

currently by farms established during economic crises, e.g., in Detroit (since 2007). Thus, UA is indicated as one of the elements shaping the food security of a region [53,62,63].

Emblematic examples are Cuban *organopónicos*, established in response to the US embargo imposed on Cuba in 1962, in addition to the economic crisis associated with the collapse of the Eastern Block in the 1990s. Previously, 80% of Cuban international trade took place between countries belonging to the Council of Mutual Economic Assistance (Comecon) [64]. The difficult economic situation and food deficit caused by a sudden lack of trading partners and economic isolation forced Cubans to develop an alternative economy based on the internal state market rather than exports and imports. At the time, UA became an important element of the country's food sovereignty.

In Havana, two models of urban farms are distinguished: Organopónicos Populares and Organopónicos de Alto Rendimiento. The first is a farm, with a size of 0.2 to 0.5 ha, where food is produced for the settlement community and local retailers; a market stall is usually located at the entrance gate (e.g., Organopónico La Sazon) (Figure 6). The name Organopónicos Populares is also used for smaller gardens established on vacant lots. By comparison, Organopónico de Alto Rendimiento is an urban farm, usually with a size over 1 ha, dedicated to intensive commercial food production [7] (e.g., the Organopónico Vivero Alamar, with an area of 10.5 ha, located in the outskirts of Havana).

The area of each *organopónico* is parceled out into beds used by individual farmers affiliated with unions or cooperatives (e.g., Unidades Básicas de Producción Cooperativa) [64]. *Organopónicos* are state farms, liable to the Ministry of Agriculture, and the farmers working there are employed on a permanent basis. The spatial layout of the farms, dimensions of arable beds, technology, and production plan are also subject to the regulations of the Cuban ministry [65,66].

In 1997, almost 21,000 tons of vegetables were produced in Havana's farms, and in 2012, the production capacity reached 63,000 tons [67]. The success of this model lies in the comprehensive approach to food system development. It also demonstrates that locating agriculture within city boundaries can be an economically attractive solution due to the presence of direct customers and organized markets.

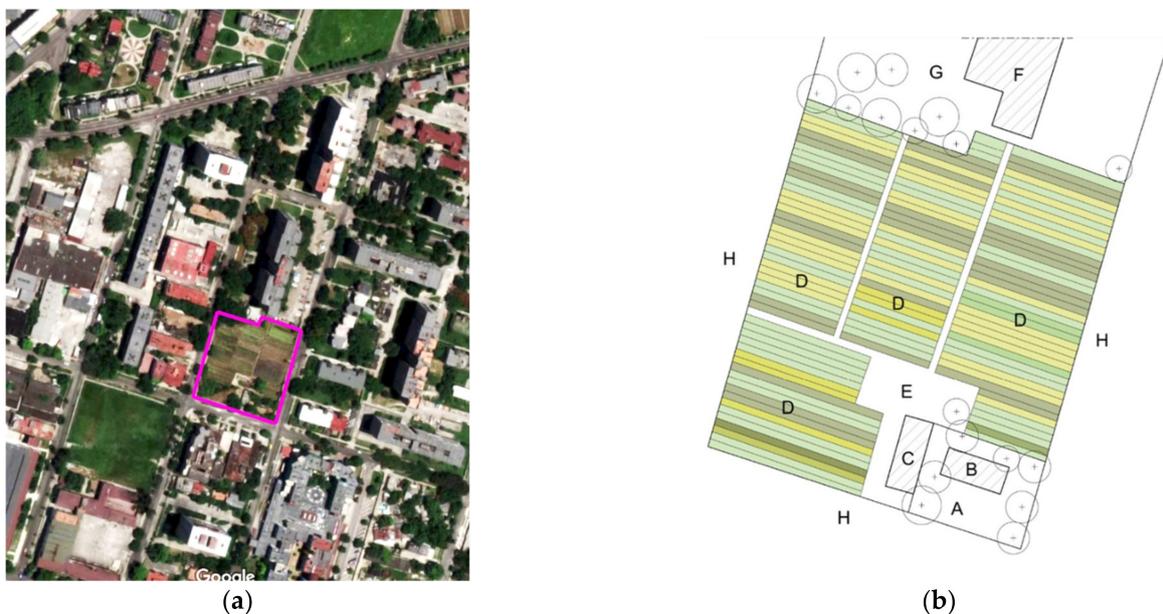


Figure 6. Organopónico La Sazon (Havana): (a). Location of the La Sazon farm in Havana [original study, based on: www.google.pl/maps, (access on 16 August 2018)]; (b). Scheme of the La Sazon farm. Explanation: A—entrance area (public space), B—market (store), C—storage room, D—crop beds, E—utility space, F—residential building, G—recreation area in a residential area, H—roads.

Creating similar food systems, according to the paradigm of sustainable development, is a living topic of interdisciplinary studies. In 2005, Wageningen University launched the Agromere project, which aims to transform a district of the Dutch town of Almere into an ecological “city-farm” by 2030 [68].

In its first phase, the research project was focused on the possibility of using depressed land for peri-urban and urban agriculture. Subsequently, applying the strategy of participation design, various stakeholder groups were invited to collaborate (e.g., residents, farmers, and entrepreneurs). The results were used in the next stage—the preparation of a UA development project [69].

In effect, Agromere became a neighborhood project for about 5000 inhabitants, covering an area of 250 ha, of which 80 ha was intended for development and urban infrastructure, and 170 ha for four urban farms: a community-supported vegetable farm, a dairy farm, a greenhouse farm, and an arable field. Furthermore, environmental and agricultural educational workshops are to take place on their premises. The project also sets goals such as: creating closed cycles of the food and urban system (e.g., waste management); local energy production from renewable sources; local consumption of half of the food produced; and only organic production within UA [69]. However, in contrast to the *organopónicos* model, the Agromere project does not aim to be self-sufficient in terms of food production. Moreover, farms in Almere are intended to be commercial enterprises.

In the Agromere project, urban open spaces, such as parks, are replaced by agrarian vegetation. Therefore, an urban “productive landscape” would be formed, similar to that of the contemporary concept of the Continuous Productive Urban Landscapes (CPULs) [66]. The term “productive landscape” reflects the meaning of undeveloped plots, which are perceived as wastelands, and thus indicates that vacant lots can be used for agrarian purposes or transformed into biologically active productive environments [54].

4. Results and Discussion

In urban planning, the key issue is distinguishing between urban and non-urban areas, e.g., rural, agrarian, and natural. In the current discourse on UA, the urban–rural dichotomy is strongly disputed [28,30,31,70–74]. Various spaces occurring “in between”, such as suburban, peri-urban, and agri-urban, continue to be observed today, and each of these spaces is characterized by their own specific features [73].

A turning point in reports that focus on shaping the urban–rural dichotomy is the Industrial Revolution and the resulting separation between agrarian land and cities [31,75]. Although the time line defined by industrialization is extremely important in the debate about cities, it does not necessarily describe the actual break in the continuity of UA. Projects and studies on the relationship between urban and agrarian areas began in parallel with cities’ growth [76]. Furthermore, new ideas of urban agriculture were implemented, such as the first allotment gardens [40,41,77]. Thus, a quick reaction to the disappearance of farming from cities was the appearance of new types of UA.

Urban planning in the 20th century included attempts to confer cities with the social-cultural properties equivalent to a rural habitat [25]. This trend was already present in the 19th century utopias of agrarian cooperatives, e.g., the phalansteries of Charles Fourier. In addition, the trend of combining urban and rural life was present in the concept of agrarian cooperatives. The current urban theory and practice was mostly influenced by the concept of Ebenezer Howard, who confronted the issues of overpopulation and uncontrolled urban expansion, and proposed a system of garden cities interwoven with agrarian and natural areas. The idea of linking agriculture with housing also found fertile ground in modernism, as exemplified by Leberecht Migge’s self-sufficient estate projects and Le Corbusier’s Ferme Radieuse. An agrarian function was included in the plans of the garden estate of the Ville Contemporaine and other unrealized projects of Le Corbusier’s residential architecture.

Numerous urban concepts of the 20th century showed a trend towards agrarian urbanism. By minimizing the differences between cities and villages, the idea of agrarian urbanism drastically breaks the canon of a historical city form. Thus, projects of decentral-

ized cities were developed with undetermined boundaries, as architecture embedded in a natural and agrarian landscape [78].

As correctly noted by Madaleno and Gurovich, at present some designers consider agrarian areas in cities (e.g., allotment gardens) as a relic of the past; that is, as former rural areas, which have erroneously, randomly, and chaotically been “incorporated” into the urban fabric, hence representing an alien element [73]. This approach is contrary to the opinion of some sustainability researchers, who suggest the combination of the urban fabric and local food production is crucial for ecological reasons [79–83]. The key issues are the reduction of food miles and the demand for processed food, production of which strains the natural environment [84–87].

Nevertheless, the public goods [88,89] of urban agriculture vary according to the solutions adopted, thus resulting in the following typology [74]:

1. Urban-architectural typology, according to which agriculture occurs in cities within:
 - peri-urban open spaces;
 - green wedges;
 - architectural objects, integrated into the building (e.g., on roofs, elevations, in interiors).
2. Landscape typology, according to which urban agriculture develops the following landscapes:
 - a hi-tech landscape—in the case of industrialized and sustainable food production with the application of soil-free tillage (e.g., vertical farms, indoor farming);
 - a landscape with rural features—in the case of traditional farming methods, related to soil (e.g., farmlands, vegetable gardens).

Moreover, development of objects and space for UA is accompanied by diverse aims, and thus operates under various forms of land ownership: public, private, or cooperative. Groups of units engaged in food production in urban areas have been widely discussed [11,39,41,90–93]. The broadest classification encompasses the basic subdivision into three groups of units: state (e.g., local authorities), non-state (e.g., non-governmental organizations), and informal (e.g., cooperatives of agricultural producers) [89].

The underlying factors that have determined the existing spatial and organizational models of UA have been aptly identified in a report on urban agriculture [55] and include:

- traditional, regional practices and agrarian systems, and their contemporary continuation;
- selection of edible plant species for cultivation;
- cultural environmental concepts and methods of environmental management;
- the Industrial Revolution, which changed methods of food production, processing, and sale;
- the Information Revolution, which allowed for global exchange of information and knowledge about urban agriculture;
- progressive urbanization after World War II (resulting in less arable land and greater demand for food in cities with increasing population);
- spaces formed due to modern urbanization (e.g., vacant lots resulting from low housing density);
- increase in the number of urban citizens with low income, for whom agriculture is a method for obtaining food.

These issues should be complemented by raising the public awareness and, consequently, social and environmental activism around the world.

Moreover, the phenomenon of UA has provoked architects and urban planners to rethink and redefine urban and rural categories. This dichotomy also loses its sense in the case of the suburbs; however, the lack of an unequivocal distinction is criticized in their context. It should be emphasized that many examples of agrarian space in metropolitan areas (and their suburbs), from a functional-social perspective, contrast with suburbs and the corresponding urban sprawl problem [74]. The discussed projects of agrarian cooperatives are in line with the low-density urbanism model, favoring sustainable de-

velopment [2,13,81,94,95]. These projects also adapt agriculture to local environmental conditions, and are managed or supported by the local community [30], in some cases based on Community-Supported Agriculture (CSA model).

Moreover, the alternative design approach is clear in the presented projects. In addition to squares, public parks, embankments, and beaches, these projects create a new type of public space—urban fields [95]. This approach implements the often-postulated idea of maintaining systemic access to food, in a manner similar to the access to drinking water. This commonly accessible tillage in cities is presently known as “public produce” [15].

However, critics of UA indicate that, in many contemporary projects, the agrarian function is not the key issue their authors would assume (e.g., Synthe roof [96]). In some cases, the agrarian function is solved too superficially. Therefore Torreggiani, Dall’Ara, and Tassinari refer to such projects as “ecological makeup” [74]. A different case occurs in UA projects that have an ecological transposition (e.g., reducing food miles by changing the food system) and a social value of providing residents with access to food.

An obstacle to the above idea is the cost of urban land, which is much more expensive than peri-urban and rural land. Therefore, it is preferred that urban lots are used by entities generating the largest income in the shortest possible time span [2]. Moreover, due to the development of urbanization, the cost of land on which agrarian practices occur will systematically rise, hence shifting the agrarian function further into the suburbs. This will have negative influence on the food security of a given region [2]. Therefore, urban food production can only be sustained by a top-down, planned integration of the agrarian function into the urban land-use policy [52], as was the case in Havana or is presently planned in the Dutch city of Almere. In addition to government support, UA should be subject to certain regulations, as is the case for all other urban activities, otherwise it may also generate environmental pollution [2,73].

A subsequent problem related to plant cultivation in the urban environment is the risk of pollution by heavy metals (e.g., arsenic, chromium, zinc, cadmium, copper, nickel, lead, and mercury). Some species of edible plants, e.g., leafy vegetables, are particularly sensitive to soil and atmospheric pollution by heavy metals, in contrast to fruit trees which are most resistant to environmental pollution [97]. Moreover, the degree of food pollution depends mainly on the location of tillage and the degree of pollution at the site itself. Due to car traffic, the largest amounts of heavy metals are accumulated in soil adjacent to streets, near waste influx into rivers, in industrial and post-industrial zones, and in areas located below polluted regions and near waste landfills [55,98]. Therefore, the concept of establishing farms in residential estates that are located a certain distance from communication routes, and surrounded by buildings and urban greenery, appears to be a correct approach. Furthermore, the safety of food produced in metropolitan areas, like that of food produced in suburban areas, depends on the applied agrarian practices and environmental purity. In summary, the quality of food produced in cities may be improved by determining special zones (e.g., in residential areas) and introducing appropriate regulations; monitoring food quality, e.g., by controlling the heavy metal content and presence of pathogens; controlling and restricting pollution caused by heavy metals in the urban environment; monitoring the disposal of liquid and solid waste; and the food education of producers and consumers.

5. Conclusions

A profound change in food systems may take place via the development of settlements with cooperative farms. Potential models may be concepts of agrarian cooperatives from the 19th and 20th centuries. The farms do not necessarily have to be cultivated by the residents themselves. Gardening requires time, knowledge, and engagement; therefore, hiring qualified farmers appears to be a more plausible idea. This does not collide with the possibility of dedicating part of the lot as a communal garden or individual allotments. Furthermore, traditional farming methods and modern soil-less technology (e.g., hydroponics and film farming) can be applied on estate farms. Such solutions have real potential

for sustainability in all its aspects—ecological, economic, and social. Therefore, the issue needs further interdisciplinary research.

Moreover, small farms in estates can be easily controlled in terms of their food quality. A suitable location for tillage is a key feature in food security, in terms of both accessibility and quality. The main obstacle is the cost of urban land, which is significantly more expensive than the cost of peri-urban and rural land. There are also concerns related to contamination of the environment. Thus, urban farms need both local government support and regulations.

Future research should examine the efficiency of urban agriculture. Researchers should further develop a comprehensive approach to food system design based on local agricultural cooperatives.

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