

## **An analysis of current integration of urban agriculture and domestic garden into urban planning: the case of Île-de-France region**

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### **Abstract**

More than a passing trend, urban agriculture (UA) has become a part of modern cities. According to some authors, it provides some ecosystem services (well-being, food, water catchment, biodiversity...) contributing to creating more liveable cities. Although these functions are recognised, not all municipalities integrate those functions into urban planning. The survey conducted on 240 land-use local plans and their integration of UA and Urban Domestic Gardens functions and issues reveal that the most expected functions are environmental, landscape management and social. We also observe that these topics are considered more in the presentation part of the plan that remains more declarative than operational and regulatory. There seem to be contextual and technical constraints on the implementation of regulatory mechanisms to preserve and develop these areas.

**Keywords:** land-use plan, functions, zoning, resilient cities

### **1. Introduction**

More than a passing trend, urban agriculture (UA) has become a part of modern cities. According to some authors, it provides some ecosystem services (well-being, food, carbon storage, water catchment, biodiversity...) contributing to creating more liveable cities (Stella *et al.*, 2022). Although these functions are recognised, they cannot be generalised. The various forms of urban agriculture<sup>1</sup> (e.g. urban domestic gardens, allotment and community gardens, multifunctional urban micro-farms, peri-urban farm in short chain) provide specific services. Home gardens, despite the non-commercial nature of food production can also contribute to the food and ecological resilience of cities by reducing the vulnerability of households in the event

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<sup>1</sup> Urban agriculture is considered as all agricultural practices and forms which supply products and/or services to the city (Aubry *et al.*, 2022) and whose use of space and resources competes with other urban activities (Moustier and Mbaye, 1999).

of economic, supply or other insecurity crises (Seeth *et al.*, 1998, Buchmann, 2009, Cerda *et al.*, 2022) and by providing a range of ecosystem services (Cameron *et al.*, 2012).

Reliable methodologies to characterise and quantify these services and their interactions are still lacking. Concerning the contribution of UA to food resilience, the literature is fragmented and not consensual. The estimations depend on UA forms and the calculation methods. On the one hand, some forms of UA have been studied more than others where home domestic gardens now seem to be gaining more attention (Marie, 2019). On the other hand, data are still needed to assess their contribution. Methods of analysis also vary from surveys that rely on declarative data to photo-interpretation estimations. Payen *et al.* (2022) examined urban agricultural productivity by a meta-analysis literature review. They demonstrate that the productivity varies according to the location (e.g., ground-based, roof-based, indoor), growing systems (e.g., hydroponics, vertical or horizontal, controlled environment or open-air, soil-based agriculture), and crops. It is even more complex to understand the correlations between functions. For example, there are still discussions with respect to the environmental efficiency of urban agriculture, which is questioned (Goldstein *et al.*, 2016) and vary according to growing systems and agricultural practices (Hawes *et al.*, 2024). As a result, statements are highly variable, and may be conflicting, depending on the context, practices and methods used. Despite this context of scientific ‘uncertainty’ and the absence of robust methods for calculating and valuating their contribution, local stakeholders enhance and implement agricultural activities into urban and peri-urban areas to expect different functions. The proliferation of public actions in favour of the development of UA seems to be mainly motivated by the potential contributions expected from the various UAs in accelerating territorial transitions (food, ecology, agriculture).

In France, the debate on sustainable cities has been profoundly impacted by legislation on planning and environment in the late 2000s, known as the “Grenelle laws” (2009-2010). This legal framework promoted the integration of environmental objectives in planning policies. It was implemented through a national action plan for “sustainable cities” (*Plan Ville Durable*, 2010), which included the program "Restoring and enhancing nature in the city" initiated by the French State Secretary for Ecology.

Maintaining urban and peri-urban agriculture has been therefore recognised as a major challenge for sustainable land management. Ten years later, in 2020, the Ministry of Social and Ecological Transition and the Ministry of Territorial Cohesion launched a new ‘roadmap for the city of tomorrow’. In this context, the National Agency for Urban Renewal (*Agence Nationale de la Rénovation Urbaine*) started in 2020 a call for "Fertile Neighborhoods", to support urban agriculture in deprived districts.

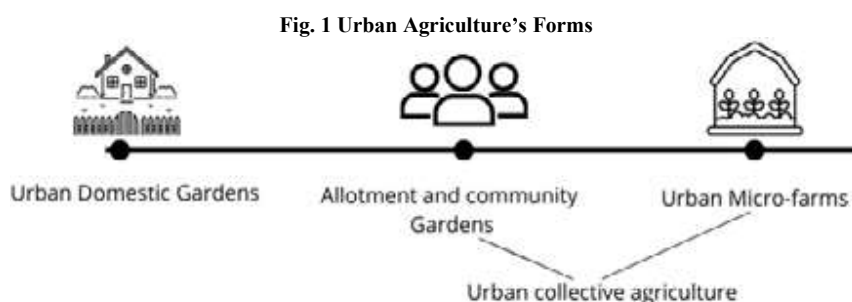
These urban planning policies identify UA as a lever for urban transformation in several dimensions which are economic (promoting the attractiveness of neighbourhoods through job creation), social (through improved living conditions and social cohesion), and environmental (through the preservation of natural resources). This transformative capacity of UA is also highlighted by the French Economic, Social and Environmental Council (CESE) in its opinion on "Urban agriculture". However, the CESE's recommendations point to the need to better integrate UA into regional planning, and to develop policies and projects that complement peri-urban and rural agriculture (in particular, food planning projects, in French “*Plans alimentaires territoriaux*”). These recommendations suggest to adapt the legal, regulatory (local land-use plans, zoning, building design) and fiscal regulations, as well as research into sustainability by taking into account the diversity of UA forms in order to promote sustainable development on a territorial scale. As noted by Consalès *et al.* (2018) it seems that only allotment gardens are truly integrated into land-use plans.

More recently, planning policies in France have moved to quantitative objectives regarding land take limitation. The 2021 Law for Climate and resilience set out a binding objective of “no net land take” (“*Zéro artificialisation nette*”), fostering a renewed interest for conciliation between urban densification and preservation of green spaces. According to the law, the planning principles may avoid damage to biodiversity, and where such damage is unavoidable, reduce it as far as possible before offsetting any residual impact that could not be prevented. These objectives are supposed to guide planning principles in terms of biodiversity protection.

In this contribution we question the role play by urban agriculture and private gardens have in the city fabric. We aim to demonstrate how urban agriculture is being integrated into urban planning, and what functions it may fulfil. How do municipalities integrate UA and UDG in territorial projects? Which issues and functions are related to UA and UDG? How does the territorial context determine the consideration for those functions?

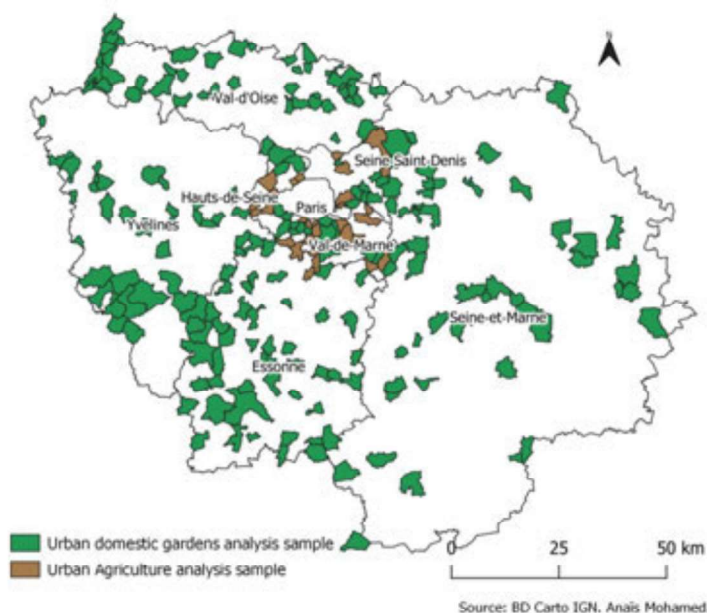
## 2. Methods

This article is based on two lines of work carried out by the authors: one specifically on domestic gardens and others on urban agriculture. These research thus have two different objects of study, on the one hand, private domestic gardens on individual housing plots in urbanised areas and, on the other hand, on urban collective agriculture’s forms: allotment gardens, community gardens, and urban microfarms (Fig.1).



Although distinct, the two surveys both question the integration of those forms of urban agriculture into the urban planning at municipal level within the Ile-de-France Region. The scope of the study focuses on urban planning documents respectively on 200 municipalities for the UDG and 40 municipalities for UA located in the Ile-de-France Region. The data set presented in this paper covers the 240 local land use plans (Fig.2).

**Fig. 2 Samples of municipalities in the Paris region according to datasets**



The interest to explore this geographical area is based on several criteria. First it is the region that concentrates the most UA projects, around 900 according to the French Professional Urban Agriculture observatory. Second, it is the most populated area and most of the population lives in an urban unit. Finally, the urban fabric is very heterogeneous including many private gardens. Indeed, in a geographical analysis of two intercommunal territories inside the Paris Region, Darly *et al.* (2021, p. 18) stated that *'vegetable home gardens account for almost half of the urban cultivated surfaces dedicated to domestic self-provisioning (alongside allotment gardens), and therefore, should be considered as a significant element of a sustainable suburban food system'*.

The analysis was conducted on the four main documents composing the local land-use plans. Those plans are composed of the overview report, the strategic project (*"plan d'aménagement et de développement durable"*), the urban design guidelines (*"orientations d'aménagement et de programmation"*) and the bylaw. The overview report sets out the characteristics of the municipality and the reasons for the choices made in the more binding documents, the strategic project and the urban design guidelines. The strategic project summarizes the major planning issues and objectives that guide a municipality's planning. The urban design guidelines focus on a limited number of major urban projects that the town hopes to implement and the specific terms and conditions for each of these projects: landscape aspects, objectives in terms of urban renewal and social diversity, targeted land and terms and conditions of acquisition, etc. Only the bylaw has legal power, as they set out the rules to be respected by each land stakeholder (developers, builders, residents).

A quantitative lexical analysis was first carried out by counting the number of occurrences of a selected word (collective or private or community or allotment garden, urban microfarms, urban agriculture, private gardens, etc...) in the urban plans. The goal was to quantify the presence/absence and frequency of different terms within the different part of those plans. This

quantitative analysis was then supplemented by a thematic analysis (Thomas, 2006) to detect the role assigned to collective urban agriculture and UDG. We choose to group the functions provided by them as faithfully as the meaning given in those documents and without applying the ecosystem services grid (biodiversity, landscapes, food provisioning...) to avoid interpretation bias.

We delved deeper with some interviews to local stakeholders (10 for collective urban agriculture and 17 for UDG). Those local stakeholders were deputy mayor delegate to town planning or environment from our respective samples who answer us positively for an interview and members of town planning firms working on the Paris region.

### **3. Results**

The date of approval of the 240 selected documents varies between 2005 and 2021. After this date, certain municipalities approved an urban planning plan at the inter-municipal level. However, it seemed interesting to present this photograph at the municipal level. At the municipal scale, it is easier to territorialise the issues and to better appreciate a diversity of treatment according to the municipalities and the UA's forms. At this scale the differences between political and territorial contexts emerge which are sometimes hidden at the inter-municipal scale.

#### **3.1. Mention of urban agriculture in local land-use plans: a limited use of the concept**

We quickly notice that there are significant differences in treatment: i-among the municipalities selected but also ii-between the presentation report, the strategic project and the urban design guidelines.

Regarding the first point, there are some municipalities that mentioned the different forms of urban collective agriculture 52 times at most and 84 times at most for urban domestic gardens, and other municipalities only once in a passive form such as *'there are urban domestic gardens in this area'*. Furthermore, concerning the urban collective agriculture, few municipalities (n=6) do not refer to any forms looked for in the text (collective gardens, community gardens, allotment gardens, urban microfarms and urban agriculture). The reasons for their absence in the land-use plans could be manifold. For example, some territories seem not to have developed such projects yet (e.g. Levallois-Perret municipality), or their implementation does not entail integration in the documents. For example, the Clichy municipality which established its plan in 2010 and modified several times till the 2019 does not mention the allotment gardens despite the fact that they have been renewed in 2018 and have been considered, as it appears on the city's website, as an *'island of freshness within a very mineral environment'*. Conversely the municipality of Boulogne-Billancourt launched a modification procedure to allow *'the introduction of provisions to promote the development of urban agriculture'*.

Concerning the second point, the presence and frequency of UA forms are greater in overview reports than in strategic projects and in urban design guidelines (document in which there are fewer). On average, the keywords researched are much more frequently mentioned in the presentation reports: an average of around 10 occurrences can be observed in these reports, compared with around 1 occurrence in strategic projects and in urban design guidelines. If we assume that there is an upward hierarchy in terms of political commitment between these documents, we can therefore say that those terms are less frequently stated in the context of concrete measures, implying a regulatory implementation. Even more so as most occurrences - regardless of the document - are passive uses of the term where 'garden' is a qualifier to describe suburban landscapes without any targeted issues being raised.

#### **3.2. What functions for urban agriculture and domestic gardens in cities?**

The thematic analysis of references in the local land-use plans carries out to highlight a ranking of stakes according to municipalities and UA forms (Tab.1).

**Tab.1 Functions associated to selected keywords.**

Functions associated with UA	Datasets		
	Urban collective agriculture (n=40)*	Urban domestic gardens (n=200)*	
Environmental functions	50 %**	Services for biodiversity	68.5%**
		Green and blue networks	51%
		Water management	34.5%
Landscape planning functions	45 %	76.5%	
Social functions (living environment, social life)	45 %	28%	
Economic	10 %	N/A	
Food self-production	5 %	4%	

\*number of local land-use plans analysed within the two surveys

\*\* % of the number of local land-use plans that mentioned related functions

In the table 1 we considered all forms of urban collective agriculture have been considered without making a distinction by type, which has been done in the following analysis. Environmental functions are one of the most highly quoted in the two datasets, all land-use plan parts combined. For urban collective agriculture, they are in first rank, quoted by 50% of municipalities they also appear to be a quarter of the total functions identified by the survey. They are related to allotment (46.8%) or community (23.4%) gardens and professional urban agriculture (14%). Most of these issues concern their contribution to the green grid and corridor, and biodiversity protection. There are specific features based on the UA types. Concerning professional urban agriculture, it is also cited as a tool to fight against heat islands and be more resilient to climate change. Furthermore, the roofs are identified to few municipalities as an undeveloped space to enhance those projects. Regarding community gardens those stakes are often associated with the social ones. For example, by emphasising that gardens are spaces where biodiversity and social bonds can be strengthened: *'Biodiversity protection must be seen as an element of "living together": community gardens or planted terraces, these spaces are meeting places that strengthen social ties, enabling people to play an active role in their well-being in the city'* (Nanterre, Local land-use plan). Regarding UDG, biodiversity support functions are in second rank, after landscape functions and are quoted by 68.5% of local-land use plans. There, advantages of UDG for green and blue networks (51%) and for water management (34.5%) are less often quoted. The pollution issues are considered in two different ways: on the one hand making sure the quality of the soil is not polluted to allow cultivation, and, on the other hand, pointing out how these spaces can contribute to reducing air pollution. One can see that municipalities do not have the same perception and management of risk (Baudalet, 2015).

The functions related to 'landscape planning' are quoted by 45% of the urban collective agriculture dataset and 76.5% of the UDG dataset. Two main issues emerge regarding urban collective agriculture. On the one hand, the desire to maintain and enhance UA areas to guarantee a balance between greens and built spaces (42% of local land-use plans). The

presence of green areas in some municipalities is also identified as characterise the territorial identity: *'Chevilly-Larue is an urbanised town with a combination of urban forms and an interweaving of planted and built-up areas that give it its identity and landscape.'* (Chevilly-Larue's land-use plan). On the other hand, UA projects as indicated as a tool to reclassify and manage the border and the fringes (17% of local land-use plans). For UDG, landscape planning - first quoted function- is related to urbanisation fringe issues too. It is also cited related to residential area identity issues because they are recognised as an important element of this area's aesthetics.

The social function emerged in second position for urban collective agriculture (45%) and lower down the ranking for the UDG dataset. For urban collective agriculture, they concern 22% of total issues quoted. Differences between urban agriculture forms emerge for the social dimension. Regarding UDG, they are associated with leisure and relaxation needs of inhabitants in an intimate space hidden by vegetation and also to the idea that UDG improve their living environment beyond private areas boundaries by greening streets. The allotment gardens are also associated most to leisure and relaxation (e.g. allotment *'gardens provide a previously underestimated means of evading the world through nature and gardening'* – Montreuil's land-use plan). The community gardens there are more references to the reclaim and opening of space to citizens and to the convivial dimension. They can also be seen as places to create new social relations between social groups based on shared issues, as in this case between peri-urban farmers and urban allotment gardeners: *"This area is also a meeting place for the gardens and the farming world. A shared space could be created to perpetuate the crops of yesteryear while fostering social links."* (Soisy-sur-École's land-use plan).

The economic functions are cited only by 10% both of municipalities and issues count and it is related to professional urban agriculture. In the Morangis urban development plan, urban agriculture is perceived as a tool for revitalising agricultural areas suggesting innovative projects and activities. In other municipalities it is more traditionally identified as promoting local activities that encourage short chains and local production. For UDG, this dimension didn't rise during the inductive thematic analysis given the non-market nature of individual gardening. The economic benefits of self-produced food for households were not discussed either.

Among the least mentioned is the food function. The issue of self-production is mentioned by only 4% of municipalities. In the following extract, the most detailed one on self-consumption that we could find, the idea of urban food governance emerges: vegetable garden would be a means of overcoming socio-economic inequalities between resident: *"However, it is worth noting the importance of gardens to local residents, as they contribute to a comfortable lifestyle (leisure gardening, production of fruit and vegetables for household consumption, for example). They also play an economic role for modest households, by encouraging the self-production of vegetables"* (Brunoy's land-use plan). Out of 200 local land-use plans, this is unfortunately the only time this dimension has been substantiated. Paradoxically, the feeding function of vegetable gardens is emphasised more often, not for human consumption, but for wildlife. They are thus seen as favourable to urban biodiversity: *"Orchards, gardens and, more generally, the 'urban' environment should be taken into account for their ecological function, particularly those linked to older housing, which can host and provide food resources for a whole range of wildlife adapted to these environments."* (Bouray-sur-Juine's land-use plan). Concerning urban collective agriculture, the supply function is cited only in two plans and it is associated with allotment and community gardens respectively as spaces that fulfil *'space for harvesting own*

*grown fruit, vegetables and flowers*' (Champigny-sur-Marne's land-use plan) and *'nourishing production function*' (Boulogne-Billancourt's land-use plan).

### 3.3 Implementation in planning bylaws

For the moment, we focused our analysis on the more descriptive parts (overview reports, strategic projects and urban design guidelines), where the issues and functions associated with urban agriculture are detailed. However, it is in the bylaw that the general rules and land-use restrictions required to achieve the objectives are set up, in line with the strategic development vision. The bylaw is binding on all public and private bodies for the execution of any works or constructions and specify the use of the land (use, nature of activities). The affectation uses are regulated by zoning according to the French Urban Planning Code: 'Urban zones' for already urbanised areas (i.e. developed areas already served by water and electricity networks), 'development zones' for underdevelopment zone, 'agricultural zones' for fields and others cultivated areas and 'natural zones' for forests, meadows and other areas of environmental interest. Each type of zone permits or prohibits specific land uses. For the dataset on collective urban agriculture, we analysed which of these zoning types was used to classify the surface areas occupied by allotment gardens, micro-farms and so on.

Almost half of the documents analysed do not address collective urban agriculture in their bylaws. Furthermore, their integration into town planning regulations is often limited to building regulations. The rules often concern the size of garden sheds regarding allotment gardens or infrastructures for urban agriculture. The French Urban Planning Code does not identify an exclusive zoning for urban agriculture. So, the municipalities care therefore free to allocate zoning according to function's priority and their development strategy. In terms of zoning, most cases of collective urban agriculture are in urban or natural zones.

If we examine in more detail, those zoning have some limitations. On the one hand, urban zones are specifically intended for urbanisation because are the *'already urbanised areas and areas where existing public facilities or those have sufficient capacity to allow constructions to be built'* (article R151-18 of French Urban Planning Code) and this zoning does not in itself protect urban agriculture forms. Collective urban agriculture can be incorporated into some sectors of this zoning, often those designated for green spaces. However, as the emphasis is elsewhere, the protection is not fully guaranteed in these zones, complementary protections should be associated. Regarding the natural zones, the article R151-24 of the French Urban Planning Code defines them as areas of the commune areas of the commune to be protected *'their character as natural areas'* or the need to *'preserve or restore natural resources'*. Construction is limited in these areas, to preserve the zone as much as possible, and thus the gardens. The written regulations may modify the rules of constructability, by accepting garden sheds, for example. The natural zone is well suited to this purpose because, in addition to including the protection of gardens in the territory's objectives, it allows the definition of specific and customised rules. However, there are also cases where these projects can be installed in all zones. For example, the municipality as Boulogne-billancourt allows the implementation of urban agriculture projects in almost all areas without confining them to a specific zoning. However, they do not think that this choice has had an impact in the development of these areas.

In very limited cases are allocated to specific zoning or agricultural (A) zones. The first solution is the least chosen, the municipality of Thiais or Vitry sur Seine mobilised a specific zoning: Nj defined respectively as a *'reserved for allotments or collective garden sites'* (Vitry's land use plan) or *"reserved for leisure activities (archery, allotment gardens)"* (Thiais' land use

*plan*). The Montreuil's land-use plan zoned the major agricultural area of 'Murs à Pêches' as agricultural zones and the municipality identified a "derogatory area". These derogatory areas are defined in the French legislation as "sectors with limited size and capacity" where limited building rights are allocated although in agricultural or natural zones.

The exception of a few derogatory areas in natural zones is also implemented to UDGs, which are almost always located in urbanised areas. So, in the UDG survey, we focus more on sub-zonings of urban areas. Municipalities can use different kinds of rules, set out in bylaws such as sub-zonings which limits the uses and actions on both public and private land within a freely defined perimeter of the urban territory:

First, there is 'protected cultivated land': It applies to land in urbanised areas such as allotment gardens, tree nurseries, orchards and any other land with agricultural vocation that has been cultivated in the past, if it is not currently being cultivated at the time of its classification. In theory - by its title - this is the protection zoning most likely to maintain the food production purpose of UDG. However, the goals of this sub-zoning defined in the national urban planning code are above all focused on the functions of maintaining biodiversity and ecological corridors: *'It may locate, in urban areas, cultivated land and undeveloped areas necessary to maintain ecological continuities to be protected and non-constructible regardless of the facilities, if any, that serve them.'* (Article L.151-23 of the French Town Planning Code). It is also used in setting up landscape buffer zones in some municipalities: "It should also be noted that to preserve landscapes, a steeper setback from agricultural and natural zones is imposed in the parts of land covered by the 'cultivated land to be protected' grid in order to ensure smoother landscape transitions." (*Longevilliers' land-use plan*). In terms of regulation, just like zoning based on 'landscape components' - defined by the same article - the defined perimeter is considered un-buildable. Unlike 'classified wooded areas' and other 'landscape features', no prior declaration is required for work on or removal of orchards. Furthermore, there are no specific rules to guarantee the quality of cultivated soil, for example, or to ensure the continued presence of certain inherited or vulnerable cultivated species. This raises the question of the relevance of this regulation in relation to its theoretical aims.

Municipalities can therefore choose to classify their UDG as 'landscape features', which gives them greater control over their land use. To justify this classification, but also because it is a function perceived more systematically than their self-production function, municipalities justify the vegetable garden's contribution to urban landscapes. It brings a hint of 'countryside' to the city: *'A significant amount of greenery, in the form of vegetable gardens, fruit trees and climbing plants on the party walls bordering the Yvette, gives the whole area a rural feel.'* (*Bures-sur-Yvette's land-use plan*).

More indirectly, vegetable gardens appear to be a positive externality on land that has been classified as un-buildable for other motives. As for example, in this commune crossed by a river, with a 'flood risk area' perimeter: *'We do have a few plots that remain, particularly at the bottom of neighbourhood X, on the banks of the Yvette, so we are in a flood-risk area. So, thanks to that, it has kept a bit of its use as a vegetable garden'* (elected town planners from an intermediate density municipality).

On the contrary, other rules that do not aim to protect these cultivated areas can have a negative impact on the practice of vegetable gardening by limiting the potential for cultivation, as illustrated here by a member of a town-planning firm interviewed: *"You have to be careful when you introduce such zoning or rules, with the actual design of the rules and the way in which they are superimposed, because you can block any use of the garden, the possibility of installing a garden shed or cultivation by prescribing too many trees, and that can also be negative for*

*biodiversity because people say: "well we can't do anything about it."* Similarly, in an almost all municipalities studied, legal uncertainty surrounding infrastructures such as greenhouses, resulting from a poor foresight by planning authorities and consultants, may be a disincentive to the establishment of perennial crops in UDGs.

#### **4. Discussions**

##### **4.1. Integration of UA and UDGs in urban planning is heterogeneous**

Although we did not carry out a comparative analysis between our keywords and other topics of interest to the planning as transport, as realised by Blanchart *et al.* (2019) concerning their survey on soil and biodiversity integration on land-use planning, the results seem similar. The findings reveal that UA and UDGs are issues which are not largely addressed in studied land-use plans. The number of occurrences is relative (52 times at most for urban collective agriculture and 84 times at most for urban domestic gardens) considering the size of these documents, which can lay 1000 pages. Moreover, it has been observed a diversity of treatment of the subject according to the municipalities based on their territorial context and willingness to integrate or not this matter in their political and territorial project. However, even when this topic is addressed, we observe that they are regarded more in the presentation part of the local land-use plan that remains more declarative than operation and regulatory.

Other unequal treatment also appears according to the urban agriculture forms. If the UDGs are almost always considered because they are associated with specific urban fabric (suburban area or individual housing), our results regarding the collective urban agriculture confirmed, as demonstrated by Consalès *et al.* (2018), that the allotment gardens are one of the forms of UA best considered by urban planning.

##### **4.2. A food function not contemplated in urban planning.**

We would like to emphasise that not all functions are equally considered. If environmental, social and landscape planning functions and associated issues (biodiversity support, flood risk management, balancing of urban and unbuilt space, social bonding...) are more or less quoted, the food production function is largely omitted. We noted a discrepancy between the functions provided by UA identified in land-use plans and those highlighted in the academic literature. Although there is still no precise estimation of the food contribution as indicated in the introduction, some authors underline vegetable gardens contribution to the food resilience (Taylor and Lovell, 2014). They increase the food security of low-income individual households (Kumar and Nair, 2004; Buchmann, 2009; Gerster-Bentaya, 2015; Siegner *et al.*, 2018), decrease the vulnerability of households in times of economic, supply or other crises (Seeth *et al.*, 1998; Buchmann, 2009) and enhance social resilience in unsecured context by promoting values such as "*diversity, self-organisation, and adaptive learning and management leading to and positive feedback loops*" (Tidball and Krasny, 2007, p. 151).

For UDG's this lack of consideration from urban planning actors can be attributed to several factors: firstly, a difficulty in identifying the extent of the vegetable gardens within UDGs: aside from food production, UDGs support a diversity of practices. When they are cultivated, it is difficult, without photo-interpretation analysis, to identify the extent of cultivation.

Secondly, there appear to be some cultural obstacles. Indeed, there seems to be a prejudice on planners' perceptions that any resident who owns a house with a garden would have an above-average income and would therefore have no economic interest in cultivating their own garden. However, some research conducted on vegetable gardens showed an important intra-

urban variation in the spatial distribution of vegetable gardens depending on the social composition of neighbourhoods and the structure of the housing stock: proportion of houses with gardens, proportion of homeowners (McClintock, 2016; Marie, 2019) and parcel size (Darly *et al.*, 2021). Furthermore, drivers for self-production may have other purposes than just economic ones, as the literature on food production in UDGs and collective gardens has shown (Schupp and Sharp, 2012; Pourias *et al.*, 2012) it can be led by rejection of unsustainable industrial food (Weber, 1998; Kortright and Wakefield 2011), cultivation of varieties or species that are not or no longer found locally - which could also be seen as an interest in the biological conservation of biodiversity (Aguilar-Støen *et al.*, 2009; Galluzzi *et al.*, 2010); or maintenance of inherited practices and varieties that contribute to the cultural identity of the inhabitants (Kortright and Wakefield, 2011; Mazumbar, 2012). However, the local urban plans analysed for this study do not take account of such issues. At urban planning scale, the food self-production is still not recognised as they should by cities to enhance local resilience.

#### **4.3. In search of zoning regulations suited to the multifunctionality of agricultural spaces**

Lastly, we would like to stress that they are no common and dedicated planning tools for UA regulation. UA projects are mostly classified in natural or urban zones, but more rarely in agricultural zones. This could be explained by the fact that the classification of an agricultural zone by national urban planning code is based on the agronomic, biological or economic potential of the agricultural land. Therefore, development rights are restricted and should be connected to agricultural activities. The urban and natural zones in some cases may be more relevant for environmental and social functions of UA. At the same time, planning regulations in urban zones allow a reversibility of land use (and greater flexibility for building rights supporting diversification in farming activities (conditioning, on-farm sale, agri-tourism, etc.). By contrast, agricultural zones may be more restrictive, except in except for derogatory areas. Aragau and Desrousseaux (2023) explored the difficulties and barriers to the implementation of agriculture into planning, through field surveys in the Paris region, and underline that local planning authorities are reluctant to implement protective regulations for farming activities, in order to give some flexibility for future housing projects. But in some cases, local initiatives promoting re-territorialisation of agriculture may help to design adapted regulations for these farming activities. A better integration of agricultural activities in planning policies is in line with on-going initiatives to connect urban and food planning (Liu, 2023).

Furthermore, the adoption of the Climate and Resilience Act<sup>2</sup> edicting the no net land take objective by 2050, will sharply limit urbanisation of forested and agricultural areas and favour densification in already urbanised areas. However, according to recent implementation decrees (Decree nr. 2023-1096, 27 November 2023) a typology of urban soils has been drawn up in which 'Areas used for residential purposes, secondary or tertiary production, or for infrastructure such as transport or logistics, where the soil is covered by herbaceous vegetation' under 2500 m<sup>2</sup> – in which most of UA could belong- will be considered as artificialised and could be used in building projects. If UA projects are not conceived and protected over a long-term period, they may be vulnerable to pressure on land in a context of intensifying urbanisation. In our opinion, the ability of stakeholders to perceive issues involved in this relocation of agriculture within cities is the main condition for the introduction of regulation protecting urban agriculture.

Our study also leads to recommendation for a dedicated legal framework (with both flexible and protective zoning) taking into account all the functions and related differences among the urban agriculture types. We suggest that specific assessment tools could be designed for UA,

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<sup>2</sup> Law n° 2023-630, 20 July 2023, facilitate the implementation of objectives to reduce land take and strengthen support for local elected representatives.

providing analysis of their potential contribution to local food consumption and to ecosystem services taking account of spatialised social inequalities (Qiu *et al.*, 2023). All forms being multifunctional, it remains a specificity linked to the vocation of market or non-market production. The challenges among the different forms of UA are not the same: a distinction should be made among the amateur gardening and the professional urban agricultural. The challenge is to be able to manage the trade-offs between social, environmental and food production functions according to the specific vocation of those different forms.

### 5. Final Remarks

The survey conducted on 240 local land-use plans and their integration of UA and UDGs functions and issues highlight that the most expected functions are related to environment, landscape management and social dimensions. The economic and food production functions are limited and not considered yet. These findings are consistent with the analysis of bylaws (which concerns in particular urban and natural zones). With our approach taking into account the various forms of urban agriculture, we were able to show that both domestic garden and collective agriculture functions need a better understanding of their functions and better tools in local land-use plans for cities' resilience.

Rethinking the place of agriculture in the city has become all the more urgent in the context of the battle against urban sprawl, which recently led to the adoption of the Climate and Resilience Act. Local authorities should increasingly be looking at the place of non-urbanised spaces and the renaturation of towns and cities including UA and UDGs' protection. Urban agriculture and urban domestic gardens are likely to contribute to cities' resilience at the lever for climate change adaptation but also for food provisioning. To be more effective the land-use planning should be integrated. Policies at a greater scale and sensitisation of local stakeholders on UA's function could lead to a better integration of environmental, social, and economic resilience provided by UA in local land-use plans.

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