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URBAN AGRICULTURE AT THE HEART OF URBAN PROJECTS: DIVERSITY OF FORMS AND FUNCTIONS

TODAY, URBAN AGRICULTURE IS PRESENT IN ALL URBAN PLANNING PROJECTS IN CORE URBAN AREAS. HOWEVER, IT REMAINS A CHANGING, MULTIFACETED AND MULTIFUNCTIONAL REALITY THAT RAISES AS MANY QUESTIONS AS IT AROUSES INTEREST. IN THIS NOTE, THE IAU ÎDF, THE ARB ÎDF AND AGROPARISTECH-INRA REVIEW THE FUNDAMENTALS OF URBAN AGRICULTURE, NAMELY ITS FORMS, FUNCTIONS AND SUSTAINABILITY. THE AIM IS TO GAIN A BETTER UNDERSTANDING OF A SUBJECT THAT IS AT THE CROSSROADS OF ECONOMIC, SOCIAL, ENVIRONMENTAL, URBAN PLANNING, FOOD SECURITY ETC. ISSUES, AND TO EXAMINE HOW IT MEETS THE CHALLENGES FACING THE TOWNS AND CITIES OF TODAY AND TOMORROW.

Since the 2000s, urban agriculture in France has developed exponentially as a result of a multitude of public and private projects and initiatives. In response to such enthusiasm, local government authorities, economic stakeholders and citizens now want the keys to understanding it. Thus, in this *Note,* the IAU îdF, the Regional Biodiversity Agency (ARB îdF) and the AgroParisTech-Inra institute present an overview of the various forms and functions of urban agriculture, taking the Paris Region as their field of observation and illustration.

THERE ARE MANY FORMS OF URBAN AGRICULTURE, NOT JUST ONE

Today, it is internationally recognised that urban agriculture is located both within and on the periphery of urban areas[1]. Through the provision of food supplies and other services (educational, environmental, social, etc.), its multifunctional role is often highlighted. It may or may not (or only partially) play a commercial role. It is often characterised by the diversity of its production systems and links with urban areas. The polymorphous nature of urban agriculture adapts to all urban substrates (land, soil, roofs, walls, parking lots, etc.).

Five major types of urban agriculture can be distinguished featuring different levels of development, trends and issues: first, peri-urban farms with short supply chains; second, communal/community gardens; third, urban micro farms; fourth, urban greenhouses and indoor systems; and fifth, individual urban agriculture.

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Cover
The Veni Verdi association creates gardens in urban areas to act on the environment and influence society. The pupils of Pierre-Mendès-France college (in the 20th district of Paris) have turned the 4,500 sq. m. of green spaces in their school into a kitchen garden with 200 fruit trees, a pond and a chicken house. Located in a listed inner-city urban policy neighbourhood, this urban micro farm helps sustain the green belt and enhance social cohesion.

URBAN AREAS AND AGRICULTURE: OSCILLATING BETWEEN LOVE AND DISENCHANTMENT

Agriculture and urban areas are historically linked. The first villages resulted directly from the domestication of plants and the emergence of livestock breeding in the Neolithic age. Urban agriculture left its mark as early as 8,000 years before our era in the Fertile Crescent and in Mesopotamia (present-day Iraq and Syria), where many orchards and vegetable crops flourished. This common destiny resembled a 1,000-count waltz, representing the key moments that have marked this relationship. The towns and cities established themselves in the most fertile regions to feed their populations. However, by expanding they consumed their own nurturing hinterland. Sometimes, in certain places, it is a town or city that has allowed agriculture to establish itself within it, as illustrated by market gardening in Paris. In 1896, the appearance of allotment gardens contributed to the introduction of intra- and peri-urban subsistence crops. A dual disconnection then took place: urban areas and agriculture turned their backs on each other. Towns and cities sought their products from further and further away thanks notably to railway and then refrigerated transport. Agriculture, for its part, turned away from towns and cities by specialising itself more in response to market forces. Under the combined influence of urbanisation, industrialisation and agro-industrial developments, vegetable gardens and crop cultivation gradually disappeared from within the walls of towns and cities.
On the other side of the Atlantic, the first community gardens appeared between 1970 and 1980. In France, by contrast, it was not until the years 2000 that the desire for urban agriculture re-appeared. The increasing importance of environmental issues and the multiplication of economic, social and food supply crises provided fertile ground for this renewal, which favoured revegetation, greater social cohesion and a higher degree of food security. This development turned out to be exponential thanks to the flourishing of new cultivation techniques and practices, but also to the emergence of new economic and political stakeholders.

Peri-urban farms with short supply chains
These farms are linked to urban areas by short food supply chains (community-supported agriculture, fresh food baskets in stations, farmers' markets, etc.). Most of them are very diversified market gardening farms, with some stockbreeding, in certain cases: they often cultivate 30 different crop species on plots of less than five hectares. Recently, there has been a "miniaturisation" trend, with new farms of less than two hectares, surface areas that used to be considered as unfit for agriculture[2], but which local authorities can find more easily available. Serving mainly niche markets [Morel, Léger, 2016], these farms focus especially on bio-intensive vegetable gardening or permaculture outdoors in open ground or under cover. Local government authorities often facilitate their access to resources (environmental leases, water, etc.) and agricultural bodies support them more and more. Their pace of development depends on the policies and suburban features of each of the towns and cities concerned. This development also contrasts with the decades of sharp decline in market gardening in urban regions such as the Paris Region (l'Île-de-France). The preservation of peri-urban agricultural spaces remains essential.

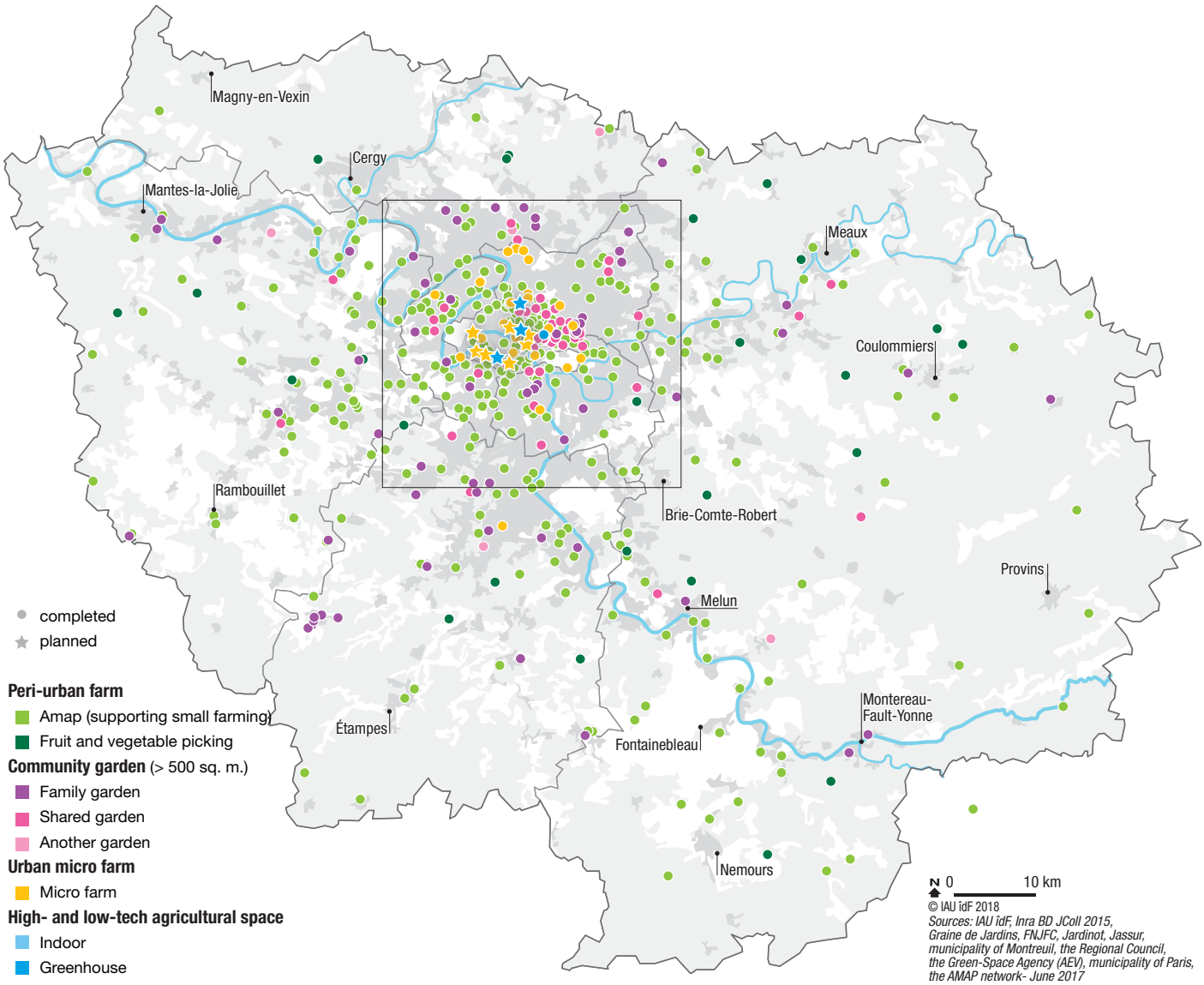
Community gardens
The number of these gardens (also known as shared or family, etc. gardens) has been growing in and around urban areas. Second only to peri-urban farms, they represent the main form of urban agriculture in terms of surface area and of the number of people involved. The family gardens set up in France in the 19th century (one plot per family on a collectively owned piece of land) have greatly changed since the emergence in the years 2000 of smaller shared gardens (single collectively cultivated plots) on collectively owned pieces of land. Conversely, "individual" micro plots have appeared within the shared gardens featuring a strong focus on "greener" practices, *i.e.* without pesticides and chemical fertilisers. Although not subjected to the market system, they can play an important role in terms of food self-production [Pourias, *et al.*, 2015]. Moreover, they promote social and educational values and provide more and more popular environmental services (urban waste recycling, biodiversity). There are often long waiting-lists, which call for the creation of new sites.

Urban micro farms
Multi-functional urban micro farms have been developing fast. On the ground or on rooftops, they generate revenues due partly to their productive function, but also to other activities and services [Daniel, 2017]: educational workshops, leisure, events, social integration of people with difficulties[3], etc. Their technical systems are often inspired by organic agriculture or permaculture, but may also be used above-ground, in the open air or in sheltered spaces.
Urban livestock production has also been expanding (bees, fowl, eco-grazing). Local government authorities are interested in functions such as the consumption of organic waste (hens), environmentally friendly grass-cutting (sheep) and fun means of creating a good atmosphere in urban areas (sheep again).

Urban greenhouse farming and indoor systems
In spite of their very limited development in Europe (only 20 existed at the end of 2017), urban greenhouses and indoor systems are often seen as symbols of urban agriculture.
Greenhouses can be installed vertically on the ground, on rooftops or as part of a building. Indoor systems allow crops to be cultivated in confined spaces within a building, in disused parking lots, containers etc. using high- or low-tech means.

Greenhouses and high-tech indoor systems monitor all or part of the environmental conservation of the crops (heating, water, nutrients, task-specific or general lighting). Their technical systems are mainly hydroponic, aquaponic and aeroponic[4]. As such, they are potentially between four and 10 times more productive per square metre than a peri-urban farm with an in-the-ground system. Designed mainly for the sale of food products *via* local short supply chains, their profitability may turn out to be jeopardised because of the large investments required in greenhouses, expensive urban land (including roofing), technical constraints (need for light roof structures) and operating costs (price per kWh), etc. Some players, such as la Ferme Urbaine Lyonnaise (FUL), are already switching to other product lines, such as pharmaceuticals or cosmetics, whose raw materials can be more profitably recycled than in the food sector.
Furthermore, there are indoor low-tech systems that allow disused underground facilities (such as parking lots, tunnels, etc.) to be put to good use, notably for cultivating rain crops (such as mushrooms, chicory, etc.) where environmental control is relatively light. These systems have tended to increase rapidly.

First focus on urban agriculture in the Paris Region: exponential development



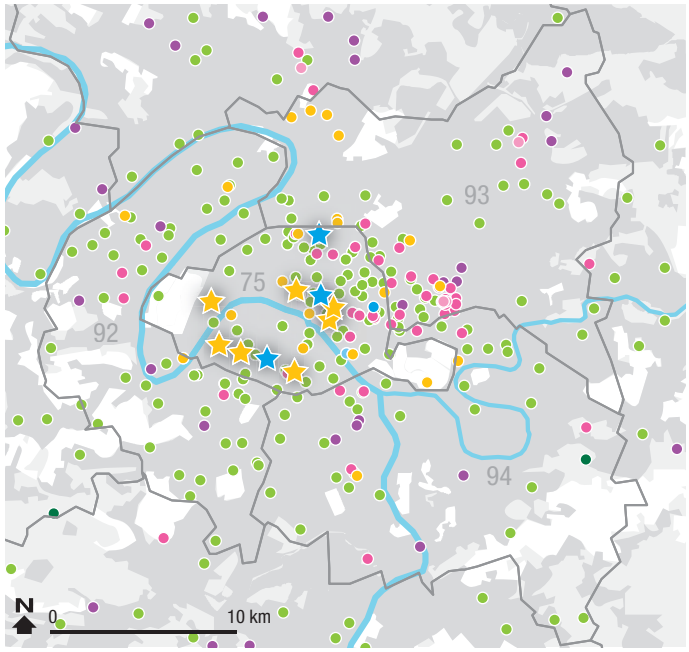
This cartography provides a first image of urban agriculture in the Paris Region. It is not intended to be exhaustive but gives some idea of the diversity and distribution of its various forms. Thus, the only peri-urban farms with short supply chains that are shown here are fruit- and vegetable-picking farms and farms that supply the AMAP network (which supports small local farming). Only community gardens with a surface area of over 500 sq. m. are shown. The urban agriculture Observatory under development by ARB îdF-IAU îdF will soon be publishing a complete review of urban agriculture in the Paris Region.

THREE KEYS TO DEFINING URBAN AGRICULTURE

Like any complex reality, various typologies have been made of urban agriculture, which is by nature inevitably ephemeral because it is so fast-changing. Nevertheless, today, three criteria seem to stand out to distinguish its various forms:

- geographical localisation: intra- or peri-urban, with different pressures on resources;
- the "economic model": sale of agricultural products, self-production outside the market system or revenues generated from the sale of products and services;
- the technical system: means of production (in soil or soilless cultivation with or without a substrate) and the degree of control over the environment (outdoor/indoor, more or less controlled environment).

These criteria make it possible to identify the five forms of urban agriculture discussed in this *Note,* namely: peri-urban farms, community gardens, micro farms, urban greenhouses and indoor systems, individual urban agriculture. This categorisation is not rigid as several different technical systems can be used in each of these forms. The innovativeness and changing nature of the forms of urban agriculture give rise to hybridisation, which enhances the wealth and adaptability of the projects.




Geoffroy Mathieu

Viltain farm, Jouy-en-Josas (78)

Peri-urban farm

Twenty-five kilometres from Paris, the plateau of Saclay offers an overview of peri-urban agriculture in the Paris Region: it features 2,500 hectares of cultivated land spanning the boarders of Essonne and Yvelines counties. Viltain farm is located on this particularly fertile land. Since the 1950s, the farm has forged close links with the local population through multiple activities. Launched in 1981, fruit and vegetable picking plays a crucial role. On 50 hectares of land, there is a great variety of fruit and vegetable including around 20 varieties of apple as well as flowers all easily available through self-service. The farm also sells its own dairy products and those of other Paris Region small farmers. Livestock breeding represents a significant share of activity with 300 dairy cows and a dairy plant for daily processing of milk in the presence of the public. Finally, the farm also grows maize, wheat and colza on 245 hectares of land.


Antoine Lagneau/ARB îdF-IAU îdF

Baudélire community garden, 18th district of Paris (75)

Communal garden

There are several dozen community gardens in the Paris Region, including over 95 in the inner city of Paris alone. One of them is the Baudélire community garden, created in 2010 in the 18th district. Located on a 130 sq. m. piece of wasteland, it brings together inhabitants who have gardening projects. It raises ecological awareness and fosters social bonding and cultural activities in socially very diverse neighbourhoods. In addition, the farm welcomes visits by school children to raise their awareness of nature and the environment. Most the crops (salads, radishes, tomatoes, potatoes, etc.) are cultivated in tanks without any chemical fertilisers or phytosanitary products, in compliance with the Green Hand charter issued by the municipality of Paris. Launched in 2002, this programme supports the association that brings together the inhabitants for the purpose of creating a communal garden.


Antoine Lagneau/ARB îdF-IAU îdF

Le Paysan Urbain farm, Romainville (93)

Urban micro farm

Since July 2015, in the town of Romainville in the eastern suburbs of Paris, the Paysan Urbain association cultivates micro-organisms. These young plants (mixed green salad, red cabbage, mustard, etc.) mature in around three weeks and contain a wealth of nutrients. They grow through soil-less cultivation in greenhouses, at natural temperatures (25°C). The Paysan Urbain farm only uses biological seeds and substratum while composting all its organic waste. Moreover, this micro farm has a social integration function by providing economic activities for people living a long way from job opportunities. Complementing these activities, the Paysan Urbain farm has created an educational garden around its greenhouses to raise public awareness and foster social bonding with the neighbourhood. This function is also fulfilled by the Veni Verdi urban micro farm association (see the cover photo) located in Pierre-Mendès-France college (20th district of Paris). This 4,500 m^2 vegetable garden is an educational instrument at the service of school children and their teachers, but also at the service of the neighbourhood's inhabitants, who can obtain the fruit and vegetables they need from this micro farm.


DR

Cycloponics, 18th district of Paris (75)

Indoor urban agriculture

Cycloponics is a start-up company specialised in transforming unused underground spaces in large towns and cities into productive and sustainable farming units. Indoor urban agriculture often uses innovative farming techniques. Cycloponics relies mainly on low-tech practices in which recycling plays an important part. In the Porte de la Chapelle neighbourhood of Paris (18th district), in 2017, the company opened a 3,600 m^2 space called "La Caverne" in a disused parking lot owned by ICF La Sablière, a social housing landlord. One of the special features of this urban farm is its certification as a biological agriculture (BA) plant. This was obtained thanks to vertical vegetable production on a BA-compatible base or substrate, without any synthetic products. Part of the space is dedicated to the production of oyster mushrooms and organic endives. The products are sold in Paris *via* various distribution channels, notably Coop Bio d'Île-de-France, thanks to the agricultural status of Cycloponic, the first French urban agriculture company to have obtained recognition of this status.

Individual urban agriculture
Finally, individual urban agriculture (on balconies, indoors, domestic chicken breeding, etc.) represents a very active market for garden centres. Revegetation by replanting edible plants has also been developing at various speeds depending on the towns or cities concerned, thanks to movements such as "Les Incroyables Comestibles" or "Permis de Végétaliser".

MULTIFUNCTIONALITY THAT MEETS THE NEEDS OF TOWNS AND CITIES

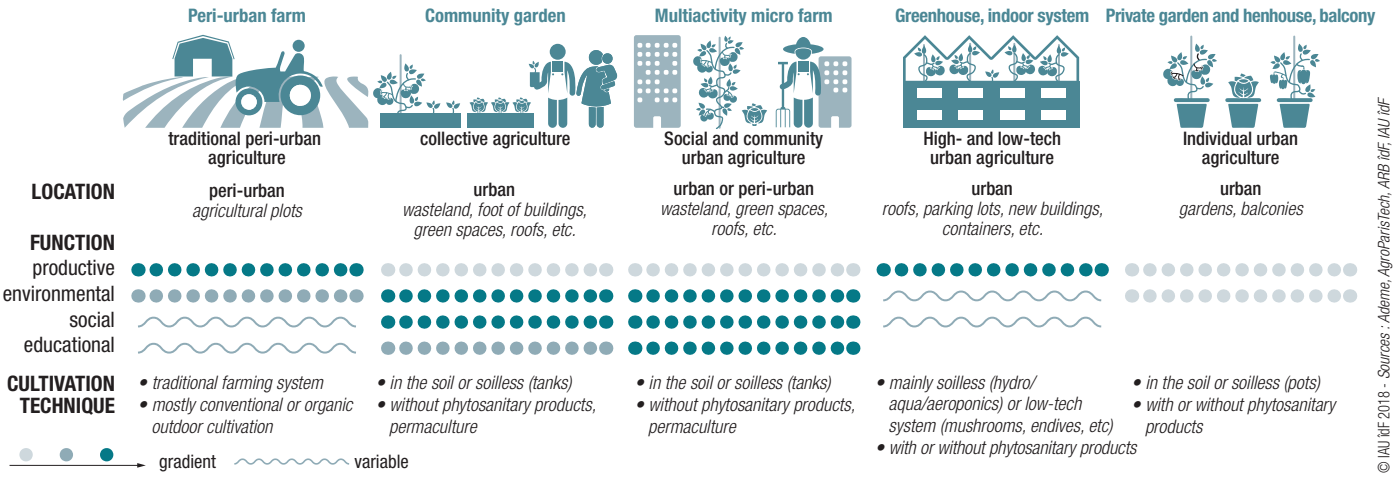
The functions of urban agriculture are multiple and differ according to the various forms of agriculture practised. The system is based on the commercialisation of products or dedicated to educational training in on-the-ground or above-the-ground cultivation, which do not fulfil the same functions. When all added together, the various types of urban agriculture present a range of functions properly attuned to the needs of towns and cities, *i.e.* food security, social cohesion, local employment, rainwater retention, biodiversity preservation, greenway networks, etc.

The food supply function
The food supply of French towns and cities is very dependent on external sources. Peri-urban farms with short supply chains are the form of agricultural activity that contributes the most to the food supply, even though they provide only a small percentage of the products actually consumed [IAU îdF, 2017]. Community/communal gardens, and even micro farms, can also contribute quantitatively and qualitatively to the food supply, even though their contributions to the fight against food insecurity remain to be proven. The role of greenhouses and high-tech indoor systems will depend on their economic sustainability and on consumer acceptance. New research has revealed the existence of two different approaches: the "high-tech" approach versus the "more natural" approach.
Air and soil pollution are often mentioned. Research shows that this risk may well exist but is often at a low level. One of the aims of research is to provide local government authorities, businesses and non-profit organisations with simple decision-making tools. The REFUGE[5] project, supported by AgroParisTech and the Paris Region, shares this aim.
The increase in the role of urban and peri-urban agriculture will depend on the outcomes of land and food management policies currently under very active preparation. The development of Territorial Food Projects (TFPs)[6] proves that there is considerable interest in this.

Social and educational functions
The main providers of this function are communal/community gardens and micro farms. Although greenhouses and indoor systems cannot really be open to the public, some of them provide outdoor training modules. Micro farms, in particular, provide a broad range of activities: training sessions, hosting of school visits, etc. Some peri-urban farms open their doors to the public (educational farms, fruit and vegetable picking units, etc.) and foster close links between producers and consumers (through the Amap consumer association supporting small farmers, fruit and vegetable picking, campaigns, etc.).

Economic functions
Local government authorities are very interested in local job creation. Agricultural employment in peri-urban farms is very seasonal, whereas micro farms and certain low-tech indoor systems often use work integration schemes for trainees and civic-service jobs, notably in socially deprived neighbourhoods, which are used as springboards for converting urban workers into agricultural workers. Economic profitability is very variable depending on whether the system works for the free market or not. The value of social and environmental services is hardly considered. Non-profit gardens, for example, have few salaried employees (apart from the manager), but represent activities recognized as being beneficial for people's health. The city of New York subsidises urban agriculture projects because of their positive impact in terms of rainwater retention. Finally, urban authorities see urban agriculture as a factor of attractiveness, which they intend to enhance.

Typology of urban agriculture: five different forms, some common functions



Environmental functions

Not all types of urban agriculture are equally worthwhile: diversified peri-urban farms, community gardens and micro farms are very useful for preserving biodiversity and recycling urban organic waste [Grard, *et al.,* 2018], such as certain indoor systems (cultivation of mushrooms using coffee grounds as a substrate). The recycling of "fresh" urban waste (canteens, catering, compost, etc.) has become a research priority and a major line of action. Applied research is very interested in other environmental impacts: water storage by rooftop farming; recovery of building heat by urban greenhouses; reduction in urban heat islands and, more generally, adaptation to climate change.

TOMORROW... SUPPORTING LOCAL GOVERNMENT AUTHORITIES AND ALL URBAN AGRICULTURE STAKEHOLDERS

At the crossroads of social, economic and environmental challenges, urban agriculture has become indispensable to urban development policies. Although the local authorities have already understood the numerous benefits of urban agriculture, they often still need to adapt in order to favour its development. Thus, many towns and cities faced with the urban regeneration of heavily built neighbourhoods are revising their Local Town Planning (PLU) in order, for example, to install greenhouses on rooftops and to take other initiatives (such as Paris et ses Parisculteurs, Arcueil ville comestible, Plaine Commune, Montrouge, etc.). More and more local authorities have appointed "urban agriculture" managers.

Faced with the diversification of, and continual change in, the forms of urban agriculture, and to meet strong citizen demand, many towns and cities have expressed the need for more support. Today, thanks to participatory programmes, such as the JASSUR[7] project on community/communal gardens and the REFUGE programme on the management of health hazards, as well as the production of fact sheets ordered by the Ecological Transition ministry, French research is more and more involved in providing local authorities with support when choosing the most appropriate forms of urban agriculture and the best methods for selecting project promoters.

The IAU îdF and the ARB îdF are also helping to increase knowledge of this subject and to help local authorities and urban agriculture stakeholders in the Paris Region. For a long time, studies have been carried out on agriculture and its role in urban planning. In recent years, the focus has been on short supply chains, revegetation, heat islands, community/communal gardens, etc. Currently, studies are in progress on biodiversity in urban agricultural areas [Lagneau, *et al.,* 2015]. Thus, thanks to its dedicated observatory, the ARB îdf has started a campaign to make a taxonomic inventory of fauna and flora in some 30 spaces, thereby extending the GROOVES[8] study of green (vegetated) roofs. These studies form part of the SEMOIRS[9] research programme for assessing biodiversity in urban micro farms. The urban agriculture and biodiversity Observatory is likely to broaden its scope of activity to cover all the functions of urban agriculture, thereby providing a comprehensive overview of urban agriculture in the Paris Region. Moreover, since 2014, the organisation of urban agriculture summer workshops has also helped to share knowledge of urban agriculture and to provide support for all the stakeholders involved.■

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1. htpp://www.fao.org/urban-agriculture/fr, visited on 2nd November 2017.
2. Changes to the agricultural guideline law (loi d'avenir pour l'agriculture, l'alimentation et la forêt de 2015) have replaced the "minimum plant surface area" (SMI), formerly the main criterion for authorisation, by the minimum taxable business criterion, which also takes into account the revenues and level of activity (working hours).
3. Social integration gardens (such as the Cocagne network) are mid-way between peri-urban farms and urban micro farms.
4. Above ground cultivation techniques for feeding plants by means of nutrient solution: water + nutrients (hydroponics); water + fish farming (aquaponics); spray mist (aeroponics).
5. REFUGE : Risques En Fermes Urbaines, Gestion et Évaluation (2016-2018); management and risk assessment of urban farms.
6. The TFPs are prepared collaboratively on the initiative of territorial stakeholders. They aim to set a strategic and operational framework for joint action in response to social, environmental, economic and health challenges.
7. JASSUR : Sustainable ANR towns, cities and buildings, 2013-2016.
8. GROOVES : Green ROOfs Verified Ecosystem Services.
9. SEMOIRS : Services Ecosystémiques Rendus par les Microfermes Urbaines et leurs Sols; Ecosystemic services rendered by urban micro farms and their soil.

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RESOURCES

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