Towards defining agricultural projects in towns: METH-EXPAU®, a multi-phase method

Giulia Giacchè, Véronique Saint-Gés, Yoann Durrieu, Mélanie Collé, Christine Aubry, Adrian Morfee

Territoire en mouvement Revue de géographie et aménagement
Territory in movement Journal of geography and planning

52 | 2022
Varia

Towards defining agricultural projects in towns: METH-EXPAU®, a multi-phase method

Giulia Giacchè, Véronique Saint-Gés, Yoann Durrieu, Mélanie Collé and Christine Aubry

Translator: Adrian Morfee

Electronic version
URL: https://journals.openedition.org/tem/9809
DOI: 10.4000/tem.9809
ISSN: 1950-5698

This article is a translation of:
Vers la définition des projets agricoles en ville : METH-EXPAU®, un itinéraire méthodologique - URL : https://journals.openedition.org/tem/8065 [fr]

Publisher
Université des Sciences et Technologies de Lille

Brought to you by INRAE Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement

Electronic reference
Giulia Giacchè, Véronique Saint-Gés, Yoann Durrieu, Mélanie Collé and Christine Aubry, "Towards defining agricultural projects in towns: METH-EXPAU®, a multi-phase method", *Territoire en mouvement Revue de géographie et aménagement* [Online], 52 | 2022, Online since 18 January 2023, connection on 08 February 2023. URL: http://journals.openedition.org/tem/9809 ; DOI: https://doi.org/10.4000/tem.9809

Towards defining agricultural projects in towns: METH-EXPAU®, a multi-phase method

Giulia Giacchè, Véronique Saint-Gés, Yoann Durrieu, Mélanie Collé and Christine Aubry

Translation : Adrian Morfee

The authors extend their warm thanks to the towns of Lille and Montrouge and to the Métropole de Bordeaux for their availability, support, and cooperation.

1. Introduction

1 Urban agriculture (UA) is booming, with a wide variety of forms, technical systems, and economic models.[1] These include peri-urban farms concentrating on the urban market, indoor and outdoor farms in towns, community or allotments gardens, small urban space horticulture, and small-scale livestock rearing (Morel-Chevillet, 2017; Lelièvre et al., 2018). UA embodies strong economic, social, and environmental values, while raising questions about food production and distribution methods (Charvet & Laureau, 2018). It responds to city dwellers' complex demand for a healthy, locally produced, affordable food supply produced in environmentally friendly ways, together with their wish for nature-based social ties and learning (Giacchè, 2016; Estival et al, 2017). Cities and large and medium-sized towns wishing to develop UA on their territory, in response to demands from inhabitants, associations, and entrepreneurs, can draw on larger schemes and movements that may be national (France's Food territorial project since 2016, the Egalim Law,[2] the Recovery Program, etc.) or even international (Transition Towns, Incredible Edibles,[3] the 2015 Milan Pact) to reorganise their food supply by building a new relation with farming (Poulot, 2015; Mathieu, 2017) or by encouraging farms to set up on their territory (Aubry et al., 2016; Baysse-Lainé et al., 2018).

2 The development of UA thus raises issues for public bodies (the Ministry of Ecological Transition and Territorial Cohesion, the Ministry of Agriculture, and the National Agency for Urban Renewal (Agence Nationale de la Rénovation Urbaine, or ANRU)), which thus adapt their policy instruments. Operational guides for local authorities, businesses, and project developers seek to regulate where urban agricultural projects are sited.[4] Indeed, creating agricultural spaces in urban environments raises new questions: should local development plans be revised, and if so how? How are health security issues to be factored in, given that urban environments are deemed polluted? How to implement projects attuned to town dwellers' many expectations? How to ensure that the choice of urban farms' technical systems, their location, and their economic and/or social model coheres with the local ecosystem?

3 Having been confronted with these questions over recent years, we have developed a multi-phase method stemming from our action research with local authorities and businesses.[5] It is based on UA's adaptation to the territorial diagnosis process as devised by Lardon & Piveteau (2005). We posit that an in-depth territorial diagnosis (TD) is needed to adapt the selected UA forms to the structural, technical, and socio-economic characteristics of the territories in question. In particular, siting an agricultural project on urban surfaces requires analysis of their agro-technical characteristics in order to select technical systems. Additionally, developing a new UA project, be it an allotment garden or a vertical farm, presupposes real knowledge of the existing and potential territorial resources, and co-construction with stakeholders in the territory, in order to encourage local inhabitants to accept the project and thereby enhance its chances of lasting over time.

4 This article goes over this multi-phase method and how it was put into practice during action research mandated by local authorities in three territories. First, after presenting the TD concept, we illustrate how it may be adapted to UA (2). In a second section we show that our TD method, applied to 3 territories with differing spatial and administrative characteristics, may be used to propose UA projects attuned to the territories' expectations and issues (3). We then discuss the benefits of this method and its application principles (4), before concluding on its prospects (5).

2. Territorial Diagnosis as an instrument to help UA projects emerge

2.1. Theoretical frame of reference for territorial diagnosis

5 TD consists in appraising the existing state of a territory's material and immaterial resources, assessing its stakeholders, and bringing out current dynamics to identify levers and obstacles for drawing up action programs. With the increasing deployment of territorialised public policies, TD is mostly conducted during coherent consultations to help decision-making by facilitating the transmission and sharing of information between different stakeholders (Reghezza-Zitt, 2015).

6 A TD is also a moment for producing knowledge to be shared with the territory's stakeholders, acting as a lever to initiate collective and concerted territorial development processes.

7 Analysis of the literature brings out the following distinctive TD components:

- **taking territories as a starting point**, viewed both as *producing specific resources* (Rapion, 1999; Senil et al., 2006) and as the *object of decision* (Chia et al., 2002);
- **focusing on stakeholders** associated with the TD to compare their points of view and bring out the spatial dimension to their strategies and practices (spaces where they live, institutional spaces, etc.) (Genevois & Carlot, 2011)
- **indications** concerning a territory's strengths and weaknesses for the issue under consideration.

8 Critical analysis of TDs in terms of sustainable development shows that they often result from juxtaposing sector-specific diagnoses without the transversal, multi-dimensional characteristics needed to implement a genuinely shared territorial project (Chia et al., 2010). Despite this, their appropriation by stakeholders and adaptation to local contexts and themes are crucial for success (Jean-Baptiste, 2017).

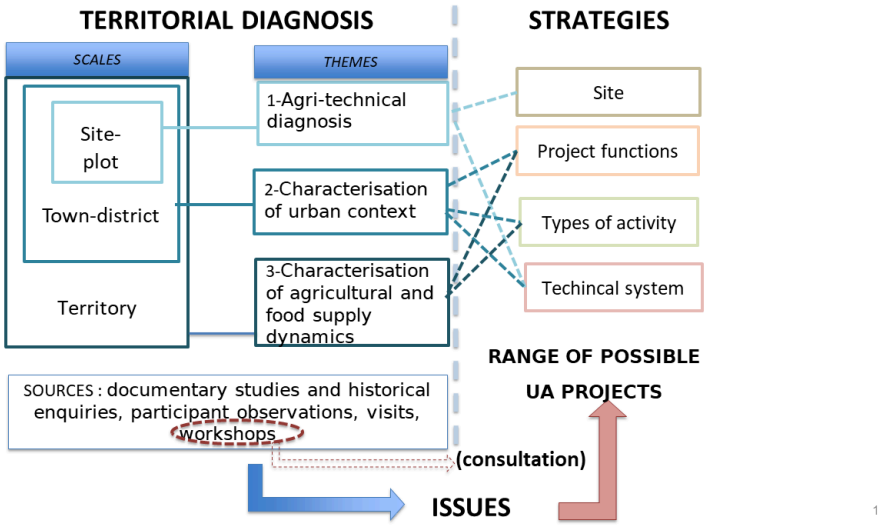
9 Over the past two decades, methods, guides, and analysis frameworks have been developed for conducting territorial diagnoses in rural territories (Chia et al. 2002; Jean-Baptiste et al., 2017) and peri-urban territories (Lardon & Piveteau, 2005; Duvernoy et al, 2012). Although similar to our purpose, these methods and frames of reference need to be specifically adapted to treat UA in its diversity. Indeed, UA is characterised by strong multi-functionality (Duchemin et al., 2010) and depends heavily on a territory's socio-economic environment. To set up a UA project, be it commercial or not, systematic transversal work is required to connect up several geographical and institutional levels (2.2).

2.2. Territorial diagnosis adapted to UA

10 The purpose of conducting a TD ahead of setting up a UA project is to identify the socio-economic ecosystem and cultivable surfaces, thus enabling a project to emerge which responds to and complements a territory's issues and its agricultural world (Charvet & Laureau, 2018). The TD thus conceived examines the production of new agricultural spaces, proposing a territorial engineering method.

11 There are three phases to our UA-adapted TD method, called METH-EXPAU® (Fig.1): i- Agri-technical diagnosis of site(s), ii- Characterisation of the urban context and its socio-economic dynamics, and iii- Characterisation of the local food supply and agricultural dynamics. These phases are carried out for scales which may vary from one territory to another. By comparing a territory's characteristics and expectations, a range of pertinent urban agricultural projects may be put together.

Fig.1. METH-EXPAU ®, UA-adapted territorial diagnosis



Source: produced by the authors

12 Table 1 shows the data sources and the methods for collecting and analysing this data. The three thematic stages are presented below.

Table 1. Data and collection methods and expected results by theme and scale

Themes/ scales	Expected knowledge	Data source	Data acquisition	Expected outcome
Agri-technical assessment / site plot	Site history, past and current uses	BASIAS, BASOL databases, archives	Consultation and analysis of documentary resources	
		Visits		Understanding of historic and current uses of site
	Agronomic and chemical quality of soils	Physico-chemical soil analysis	Soil samples	Indications about UA forms and technical systems compatible with the site's technical characteristics
	Technical characteristics: accessibility, surfaces, access to fluids	Site mapping	Obtaining technical data	
		Site visit	Field collection	
		Observation and interviews		
	Site owner and manager	Surveys	Semi-directive interviews	Indications about management and contracts with project developers

Urban/district context	Socio-spatial configuration of urban fabric	Aerial photos, site visits, mapping, planning documents		Connectivity, accessibility, and complementarity with the environment
			Analysis of maps and documents	
	Infrastructure, mobility, blue-green networks			
	Economic activities and socio-economic characteristics of inhabitants	Social economic statistics (INSEE), planning documents	Analysis of documentary resources, interviews	Indications about desired functions (training, recreational, food provision, etc.)
	Acceptability	Surveys (associations, residents, local committees), participatory budgeting	Analysis of stakeholders' discourse	Indications about un(acceptable) forms and technical systems
	Future development plans	Plans and documents, participatory budgeting	Analysis of documents and stakeholders' discourse	Projections about what the district will become
		Surveys of councillors, developers.		
Food and agricultural dynamic / department	Existing EU project(s)	Aerial photos, documents (reports), Internet, surveys;	Analysis of documentary resources	Form of complementarity with other projects in urban and peri-urban spaces
	Local farming and food policies	Guidelines (e.g., farming charter, planning documents, etc.),	Analysis of documents and stakeholders' discourse	Indications on coherence with the territory
	Local farming fabric (type, transmission, local distribution network, etc.)	Surveys (associations, residents, project developers, urban farmers, etc.),	Market surveys/ potential market surveys	Indications on characterisation of farming sectors and their development potential

		Farming bodies (Chambers, regional directorates, etc.)	Descriptive statistical analysis	
		Surveys of territory stakeholders (associations, farmers, institutions, researchers, etc.)	Discourse analysis using an interpretative framework	

Source: produced by the authors

2.2.1. Agri-technical diagnosis

13 The purpose of the Agri-Technical Diagnosis (ATD), conducted on the scale of the site(s) concerned for setting up an UA project, is to define the physical and agri-technical characteristics (physical and agronomic qualities of soils, surfaces, accessibility, access to water, etc.) conditioning UA practices and technical systems. This phase is based on site visits, historical studies of document bases, and agronomic analyses. The goal is to ascertain the constraints and technical potential of the site and plots, the size and distribution of plots, accessibility, plot security, access to water and electricity, wastewater evacuation networks, shared logistics (waste), and premises (sanitary facilities and storage). It is also a matter of defining any official and unofficial uses of the site. In the case of roof terraces,[6] specific constraints are factored in, such as weight-bearing capacity, permeability, and the presence of guardrails.

14 By studying municipal and departmental archives and databases about soil pollution, one can understand former uses (infill, landfill, industrial or farming use, etc.), and thus establish guidelines for studying soil quality. More precise agronomic and chemical analysis of the soil (for heavy metals, polycyclic aromatic, and other organic compounds) is carried out following a sampling protocol established by the REFUGE guide (Barbillon et al, 2020). All the data about the quality of air, water, etc., make it possible to detect sources of contamination, and climate data (hours of sunshine, rainfall, temperatures, and wind exposure) are factored in to analyse the site's potential.

15 Discussions with the manager/owner of the site(s) are crucial for understanding any legal and perhaps political constraints. The ATD thus provides a way of establishing a range of uses and technical systems compatible with the site characteristics.

2.2.2. Characterising the surrounding socio-economic context

16 Characterising the socio-economic context (CSEC) is conducted at the scale of the district or town depending on the specific case. Initial appreciation of the urban fabric is provided by analysing its spatial components (morphology of the urban fabric, types of dwelling, transport infrastructure, any types of green space, etc.). This is followed by studying various local planning documents and blueprints, INSEE data, and the overall

policy of the territories concerned.[7] These provide a snapshot of the predominant functions (residential, business, industrial, mixed, etc.) and of the socio-economic dynamic (business sectors, sociodemographic data, uses of sites) (Table 1). Analysis of administrative documents, deliberations by local authorities, and interviews of institutional stakeholders (councillors, technical services, chambers of agriculture, and regional directorates of agriculture, forestry, and food) provides context for the issues, expectations, and programmes for the territory as a whole. Lastly, individual or group semi-directive interviews are conducted, especially with district associations, to learn about town dwellers' requirements. The interview framework used is divided into three parts: i- what they know about UA and the functions they wish to see; ii- what type of involvement in project(s) and their insertion in the territory; iii- potential tensions or conflicts in use of the site(s) under consideration. Interviews provide a way of understanding inhabitants' representations of UA forms (community projects, business projects, etc.) while ascertaining their acceptability, the potential for citizen involvement, and expectations in terms of local food supply and other services (such as education).

2.2.3. The territory's agricultural and food supply dynamics

17 The purpose of agricultural and food supply dynamics (AFSD) is to identify levers and obstacles to a UA project in the territory relating to local agricultural and food supply dynamics. The territorial scale of this analysis (municipal groupings, the department, the region) depends on the context. Analysing strategic or prospective relations for the entire food supply system as formulated by associations or institutional stakeholders (chambers of agriculture, trade unions, local authorities, and the state) brings out issues relating to agriculture in the territory.

18 In parallel to this, the local ecosystem is mapped (e.g., councillors, residents' associations, chamber of agriculture, social economy networks, food retailing, first-stage agri-food processing, businesses and business clubs, schools and training centres, etc.). It is a matter of identifying actors already involved in UA and those who could be called upon to act as project developers, promoters, funders, etc., or those who might be against a UA project. This provides a way of getting to know those involved in farming and UA project(s), potentially enabling them to take part in developing these projects, and to explain any complementarities or likely clashes.

19 Interviews of selected stakeholders brings out obstacles, levers, and possible partnerships for UA project(s). A 5-part interview framework is drawn up: i- presentation of stakeholder, ii- what they know about UA and what representations they have of it; iii- what their organisation's roles and functions are; iv- what potential there is for their partnering or being involved in the future UA project; v-what the factors are for the success of the UA project, or obstacles to its implementation.

20 Analysis brings out complementarities (type of products, systems, and functions provided, production timeframes, publics etc.) and any likely competition with urban, peri-urban, and rural agriculture, along with the functional and economic possibilities of a future UA project.

2.3 Towards a range of possible UA forms for setting up joint projects

21 Identifying possible forms of UA, or those to be ruled out, is based both on the limitations and potentials of the site selected in the wake of the three phases reviewing the existing situation, and on the expected activities responding to the territory's needs (for agricultural training, biowaste management, food production, etc.). The case studies which follow illustrate how sites may be chosen either due to prior identification or as a result of the preceding assessment phases. We then compare the results of the three thematic diagnoses presented above, and discuss the issues which emerged in the three domains explored and at the three spatial scales investigated. The UA issues and dynamics are then schematised. The TD closes with a prospective phase based on a multi-stakeholder workshop. Comparing the views of territorial stakeholders is desirable to: i-confirm the issues; ii-determine the relevant activities (agriculture production, other services) given the territorial issues; iii- facilitate discussion between stakeholders from different horizons, making it possible to decide upon a UA project by ranking the wished-for forms and territorial insertion.

22 This stance is grounded in a territorialist approach (Magnaghi, 2010) to development based on collective recognition of territorial resources. The intention is to enable all participants to fully take part in exchanges from their perspective positions, and so find overlap in their visions for territorial development.

3. Applying the urban agriculture TD in three local authorities

23 Three case studies from our action research are presented here: Montrouge, Lille, and Bordeaux. The UA projects pertained to different spatial scales (an entire town for Montrouge, a priority development area for Lille, and a new district for Bordeaux), providing a way of testing each aspect of the TD. The three cases also differ greatly in terms of population density and, of course, geographical location (Table 2).

Table 2. Main characteristics of the three case studies

Place	**Montrouge**	**Lille**	**Bordeaux**
Region	Ile de France	Hauts-de-France	Nouvelle-Aquitaine
Population	48,991	232,787	783,081
Surface area	2.1 km^2	34.8 Km^2	570 km^2
Density pop/km^2	23,329	6,689	1,373
Surface area of green spaces accessible per inhabitant	2 m^2	14.64 m^2	48 m^2
Type of district concerned by the project (s)	Entire town	NPNRU sector[8]	New district

Site(s)	To be determined via the TD	To be decided out of 11 ha of green spaces	3.5 ha targeted out of the 90 ha of the district as a whole

Source: produced by the authors

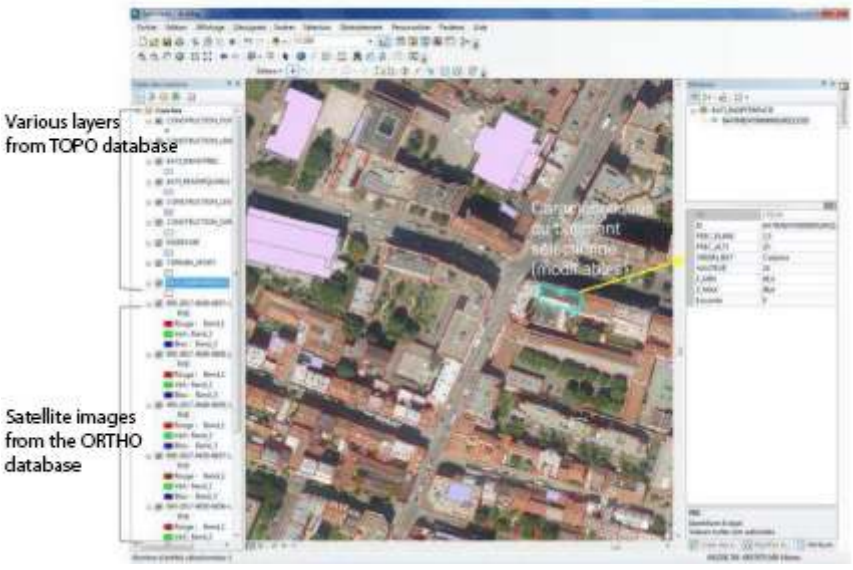
3.1. Urban agriculture in Montrouge: a good fit between political ambitions and the few available plots

24 The mayor of Montrouge (Union of Democrats and Independents), elected in 2017, identified UA as an opportunity for greening the town in response to an upswell in demand among inhabitants, for raising awareness of issues relating to a healthy diet, and for creating a positive image with produce grown in the town. The municipality thus wished to develop UA by setting up local chains for urban farm produce. Our action research consisted in determining Montrouge's potential in terms of surface area and stakeholders to involve, and the pertinence of this project for the town as a whole.

The agri-technical diagnosis: soil contamination yet strong potential for green roofs

25 The ATD enabled us to identify 915 flat roofs (fig.2). The method, inspired by the Atelier Parisien d'Urbanisme-APUR (2013),[9] uses satellite data to quantify the surface area of flat roofs, which in Montrouge amounted to 25.7 ha (12% of the municipality's surface area). Nearly 14 ha were made up of "high potential" roofs (over 200m² and with a small footprint). As for ground surfaces, there were 64 covering a total of 13ha, of which 7.6 ha were usable. These very fragmented surfaces, some of which were in the shade and partly covered by impervious surfaces, were nevertheless a resource with the potential to meet inhabitants' requests.

Fig.2. Identification of flat roofs in the town of Montrouge



Source: Glady et al., 2018.[10]

26 The municipality selected 12 of the sites identified (five roofs and seven ground sites), favouring fair distribution between neighbourhoods, and prioritising land controlled by public authorities and with a surface of at least 200m^2. However, the second stage of the ATD brought out major obstacles to developing UA projects.

27 For the roofs, the limiting factors were accessibility and weight-bearing capacity, together with preparatory costs (for waterproofing, guardrails, etc.) to equip them for a UA project. For the ground sites, we found two major limitations: i-the chemical quality of the soil, often causing above-ground cultivation to be preferable, and ii- problems in accessing spaces due to their other functions (for schooling, etc.).

28 After this stage, 7 sites were selected for UA projects, with the only remaining roof being that of a school which had recently been refurbished by the municipality.

Inhabitants' demand for nature in a dense town

29 Lying just outside Paris, and with a fairly young and dynamic population, Montrouge is an attractive town for SMEs and large businesses. However, representatives from the six district committees told us that Montrouge was perceived as mineral, with little access to green spaces; they also reported a virtually unanimous interest for UA as a way to embellish the district rather than as a form of productive agriculture. Thus 41 citizen proposals for the 2017 participatory budget related to planting and to UA.[11] The 7 projects which received funding were to create places "for green pauses, for aesthetic reasons, or for a bite to eat", or for "sharing by all age groups", or even to "bring the countryside and forest into the town" by introducing various land restoration schemes. During the "*Inspirations Végétales* 1" festival the municipality staged in 2018, 40 interviewees expressed very similar interests: 11 suggested creating planting areas (especially under trees), 19 wanted a community gardens, and 10 wanted to implement a UA project in their block of flats. These proposals reflect individual wishes to have a space to grow produce, alone or as a group, or a wish to learn or receive training with an eye to a career change, and even a new way of envisioning the town and its spaces.

A favourable institutional context for the development of urban agriculture but demand for UA products to be built up

30 An exploratory survey looking at demand for UA products conducted with 29 shops, restaurants, and groceries in Montrouge showed interest in fresh, tasty, locally produced, mainstream products (tomatoes, assorted salad greens, lettuces, and mushrooms), with price being an important factor (Morel, 2018).[12] Restaurateurs wanted distribution networks to be as effective as those of Rungis.[13] Shopkeepers emphasised that there was no label for UA products and highlighted the need to inform consumers about these new products. Various initiatives could help build up a local market segment and so make UA products accessible: creating a delivery service, providing storage and processing spaces, help promoting products to shopkeepers, an effective communication campaign, and setting up a working group of multiple shareholders. Institutional and economic shareholders were in favour of developing UA, but the predominance of small, fragmented surfaces, as well as the work needed to prepare roofs , were technical limits.[14]

Forms of urban agriculture in Montrouge, between community gardens and professional urban agriculture

31 The town had imagined setting up UA mainly on roofs and especially by developing local direct chains, but its expectations changed over the course of the METH-EXPAU® phases. Ground spaces turned out to be capable of partly meeting residents' needs to access natural and garden spaces in town, whereas colonising roofs is very difficult. Thus METH-EXPAU® provided a way of studying the territory's possibilities in the light of citizens' expectations, and helped the local authorities decide to privilege setting up UA projects. Between 2018 and 2019, 5 community gardens were created together with inhabitants' associations to manage them. Equally, 2 professional projects (to produce saffron and red berries) were set up in the wake of a call for expressions of interest (CEI) launched in 2018.

32 Setting up these "pilot" projects was a learning process for the municipality, and helped it establish clear and appropriate procedures for their implementation (a toolkit for community gardens, launch of planting permits,[15] a CEI to identify project leaders) and early-stage monitoring. Equally, the head of green spaces was named as the referent for technical aspects, in charge of centralising implementation and of monitoring projects in accordance with wishes expressed by inhabitants and project developers.

3.2. Enhancing the 'Concorde' priority district in Lille

33 In 2014, the Concorde area in the Faubourg de Béthune district in Lille was recognised as a project of national interest under the new national urban renewal programme (Nouveau Programme National de Renouvellement Urbain-NPNRU). This represented a major opportunity for the town to invigorate this zone. Renovating its housing was a priority, as was upgrading equipment to provide better transport links. Noise and air pollution caused by the nearby A25 motorway were among the health issues facing residents. Another major point was the difficulty economically vulnerable populations had in accessing good quality food. The idea of a "positive health district" was taken up as a guideline by the municipality.

34 In 2016, our action research, in partnership with the Lille Institut Supérieur Agronomique, examined the feasibility of developing UA in the Concorde district.

Agri-technical diagnosis: suitable grounds for an agricultural project but requiring major development

35 The district has 11 ha of green spaces, on an undulating zone above the A25 motorway, but they are rarely visited as people feel unsafe there. Thanks to the agri-geophysical study, a 3,500 m² plot near the motorway was identified, together with a second 4,000 m² plot at the foot of tower blocks.

36 It was only possible to conduct part of the ATD. Its results showed that the plots were composed of infill with a shallow layer of tillable soil of good agronomic quality. However, soil analysis detected contamination at depths of between 3 m and 5 m. There was no access to water, and no buildings, factors to be taken into consideration for the project.

Local political and socio-economic context: a cultural and economic dynamic to support a farming project

37 Concorde is home to 1,500 social dwellings and a population of about 4,000 inhabitants who are very economically vulnerable. It is lies in a priority district for the municipality, yet despite having good transport links (the A25 motorway, a main road, buses, and an underground) it struggles to reduce its social and economic isolation.

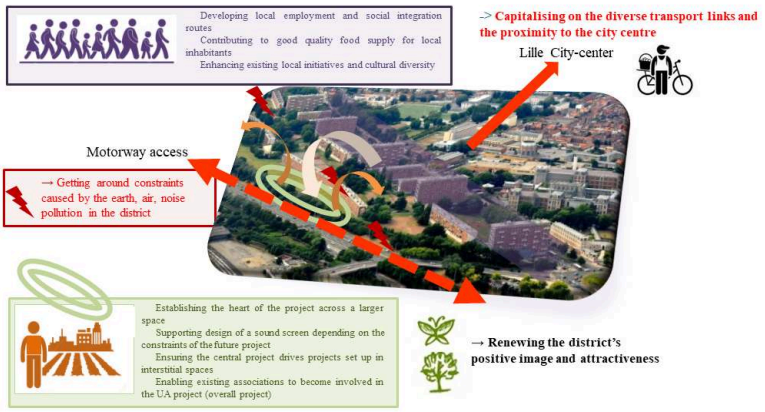
38 The local associations surveyed were actively involved with inhabitants, and reported strong levels of solidarity among them. 28% of the population are foreigners (INSEE 2006), with over 45 different nationalities. “All those at the end of their migration end up here when they arrive in Lille,” in the words of one inhabitant. They often come from a rural background and are not always at ease with city life. “They are genuinely uprooted,” in the words of another inhabitant. Many residents, especially women, prepare traditional meals and transmit this cultural heritage to their children. Food provides a strong link with their country of origin, and some sell meals or traditional produce in the local grocery or market.

39 Certain inhabitants pin their hopes on land projects to create employment and generate neighbourly ties.[16] There is a municipal scheme for family allotments, in which inhabitants frequently share or give produce, showing the interest and need even for inhabitants in the Concorde sector to have access to fresh vegetables: all reckon that there are not enough allotments to meet needs.

The territory’s agricultural and food supply dynamics: a policy to support local farming

40 Lille has a well-developed commitment to agriculture. Stakeholders work to inform and reconnect the public with matters relating to farming and food supply (e.g., Association des Jardins Ouverts mais Néanmoins Clôturés, Ferme de la Gare Saint Sauveur, etc.) while others focus on social integration (Lille Sud Insertion, Les Jardins dans la Ville, Vitamine T, etc.). About 43% of farms in the Métropole Européenne de Lille sell all or part of their produce locally, illustrating their business-generating capacity. There is little organic farming (ten or so accredited organic farms, amounting to 0.15% of the farmed surface area).[17] Synergies could be created between the Concorde project and existing schemes to help it feed into an overall territorial dynamic and benefit from the precious support of an existing network. Health emerged as a major issue (Fig.3) among respondents, as did creating local jobs and training.

Figure 3. Map of issues for establishing a UA project in the Concorde sector.



2

Source: Exp'AU, 2016

41 Another concern was contributing to the supply of affordable, good quality produce for the population. Furthermore, the knowledge of inhabitants who still have strong connections to their rural and sometimes farming backgrounds could be leveraged for the UA project.

Towards drawing up a multiform UA project for the Concorde sector

42 Taking this data as its starting point, our action research recommended a multiform UA project with economic, social, and solidarity objectives, and identified three combinable approaches: i- creating an urban farm to produce crops mainly above-ground (in greenhouses) while privileging social integration schemes, ii- setting up and expanding processing workshops to build links with farming in the Métropole Européenne de Lille, helping to create jobs and add value to local produce, iii- diversification towards the eco-management of green spaces, or production even of plants for the city. Our study concluded with the idea of launching an open call for other ideas and projects, taking care to associate the population from the outset, a key factor in ensuring that the project lasted over time. This suggestion was taken up by the municipality, which issued a call for expression of interest in summer 2018.

3.3. A future "nature" district in Bordeaux - La Jallère

43 In 2018, Bordeaux Métropole (BM) implemented a development programme for a new district, La Jallère, covering over 90 hectares (45 ha of which belonged to BM), part of which was already home to tertiary activities. BM's non-modifiable conditions included preserving wetlands and biodiversity, ecological maintenance of 30 ha of green spaces, and sustainable transport. Social housing was to account for 30% of the overall mix, and a tramline was to be extended to connect the district to Bordeaux city centre.

44 Our action research commissioned by BM in 2018 studied the feasibility of siting a professional urban farm in the district. This project was to have ties to the economic

organisations present in the district and their employees, as well as future inhabitants, while complementing local farming zones.

Agri-technical diagnosis: an uncultivated natural space with contaminated infill

45 The space set aside for an urban agricultural project formed a single 3.5-hectare plot, making it easier to establish agricultural activity. However, the ATD showed that the chemical composition of the soil was heterogenous and ill-suited to soil-grown cultivation, with very alkaline pH, little organic material, and contamination by heavy metals and hydrocarbons throughout the plot, with high concentrations in certain places. Consequently, only above-ground techniques were feasible, otherwise expensive excavation works would have been required that were incompatible with preserving the environment.

A new district where the town abuts the countryside

46 This new district to the north of Bordeaux will combine housing, business activities, and urban farming.[18] BM wishes it to be a multifunctional "nature" district, and a beacon for sustainable development. However, our survey showed that the site was generally not attractive, "the district is unsafe, with frequent degradation", according to certain people, something the new district was meant to remedy.

47 Our socio-economic analysis identified the need to boost the profile of the future farm by connecting it to the district's economic activity, to city inhabitants, and to future residents. Some of the housing would have gardens. However, city dwellers are less and less familiar with farming and gardening knowledge. These inhabitants could be the future clients of the farm for buying plants and vegetables, as well as for workshops to be run for adults and children and for advice on how to cultivate their gardens. There is little such training in Bordeaux, and none near La Jallère. Restaurateurs and/or supermarkets within a 5 km radius could be potential clients for the farm, with employees of local businesses being potential clients for fresh vegetables.

The territory's agricultural and food supply dynamics: an urban agricultural project with potential to integrate the local market gardening and horticultural segment

48 Study of the AFSD indicated difficulties in accessing land for new farms in the metropolitan area and a dearth of food production. There is also far less organic produce than needed to meet demand (Chambre de l'agriculture de la Gironde, 2012). Farmers and the chamber of agriculture were initially doubtful about the UA project, reporting a lack of old local varieties of fruit and vegetable plants. Additionally, the territory did not have a composting unit capable of processing the large volumes of waste generated by collective catering. Les Détritivores, a Bordeaux association to help people find employment, met some of this need. Developing composting facilities in La Jallère could help meet local organic farming needs.

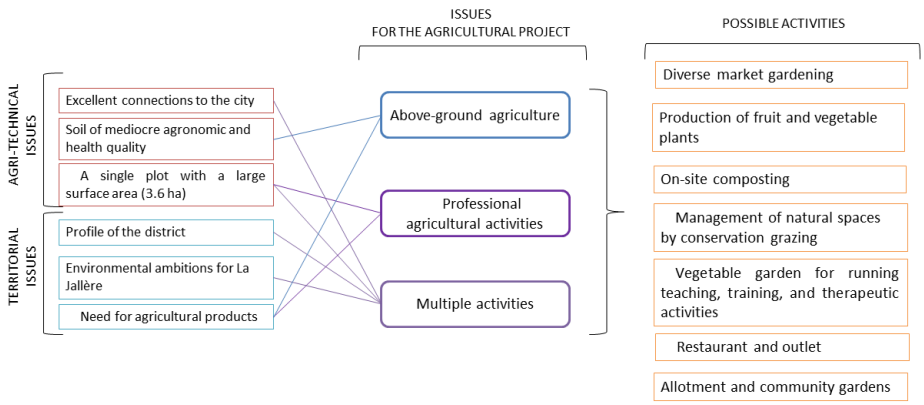
49 Despite there being over 150 community gardens and 4 family allotment sites across the city as a whole, this is insufficient to meet Bordeaux residents' demand. Thus, the La Jallère project could usefully devote some space to small plots in tubs on a solid substrate to be used by inhabitants.

The range of possibilities for La Jallere

50 During interviews and the collective workshop, agricultural stakeholders (farmers, the chamber of agriculture, agricultural training bodies, etc.), together with associations, businesses, NGOs, and institutions (the metropolitan municipality, the department, etc.) expressed a wish to be involved in this project once it was being implemented (including possible partnerships). A second important point was to make sure that this project did not directly compete with nearby farming. Lastly, farming was to be carried out in a healthy and environmentally friendly way (without any risks of pollution), with affordable produce.

51 The TD (ATD, CCSE, and AFSD) identified shared objectives resulting in three proposals for an urban farm (Fig.4): 1- an urban farm with above-ground production in greenhouses (with two points requiring particular attention, the need for major initial outlay, and the need to integrate the surfaces into the landscape), 2- a set of community gardens, a proposal with a very strong social dimension requiring the local authority to invest in developing the site, particularly via major works to manage contaminated earth (by reconstituting and recovering the soil) and, second, to employ someone to offer technical support and manage the allotments, 3- a multifunctional urban farm combining service activities (composting, allotment maintenance, workshops, conservation grazing, a restaurant and/or sale of produce), and production of crops (vegetables and herbs) on a cultivation substrate, and/or of high added value produce (such as plants with therapeutic or cosmetic active ingredients). The available surface area was an undeniable advantage for establishing a range of above-ground food production activities and for thinking in terms of multiple activities and functions: urban development (wellness, a local green space, etc.), the economy (creating localised jobs, professional integration, educational aspects), the environment (a little oasis of cool air, waste recycling), food safety, health (better quality food), leisure activities, and creating social ties.

Figure 4. The range of possibilities for La Jallere in Bordeaux



Source: Exp'Au, 2019

52 The conditions for developing this project changed in 2020, due to the health crisis plus a change in city governance in the wake of municipal elections.

4. Territorial diagnosis: an instrument for drawing up a UA territorial project

4.1. Montrouge, Lille, and Bordeaux: towards which territorial project?

53 The territorial diagnosis adapted to urban agriculture conducted in these three cases, using the METH-EXPAU® method, brought out key information for future UA projects (Table 3), guiding local authority thinking for adapting their UA project(s) to local specificities.

Table 3: decisive criteria for drawing up UA scenarios

TD phases	**Montrouge**	**Lille**	**Bordeaux**
Phase 1: ATD	Contamination Accessibility and cost of equipping roofs	Contamination Lack of infrastructure	Contamination Interesting -sized single plot
Phase 2: CCSE	Good travel links Urban density Young and dynamic population Demand for access to nature	Sector with good links but hemmed in 100% social housing Strong social mix Demand for fresh food and access to jobs	New district targeting social mix and nature Good transport links but “negative” image
Phase 3: AFSD	Proximity to Rungis Favourable institutional environment for setting up UA project	Potential for developing local distribution networks	Lack of fruit and vegetable plants, of composting, and of services for education/ outreach
Post-TD – recommendations for UA scenarios	Community gardens Professional projects focusing on education and complementary production for Rungis	1-Productive urban farm 2-Processing workshops 3-Eco-management of green spaces	1-Productive urban farm 2-Gardens for teaching and training 3-Multi-function urban micro-farm

Source: produced by the authors

54 We partly validated the initial hypothesis by showing that the structural, technical, and social characteristics of the spaces and stakeholders concerned could lead to certain forms of UA being ruled out which did not (yet) correspond to the territory’s needs (a

local farming micro-segment in Montrouge) or were ill-adapted to the spaces identified (soil-grown produce in La Jallère). Generally, the TD thus brought out the sites' potentials on various scales, together with local needs, and made it possible to plan UA projects and actions in the light of the resources identified.

55 The ATD, conducted to varying levels of detail, given the scales and means available in these three cases, brought out common problems relating to the contamination of urban soil. The REFUGE method (Barbillon et al, 2020) devised to characterise and manage risks associated with contamination made it possible to make recommendations as to which forms of UA were (un)acceptable.

56 At Montrouge, analysis of the very extensive roof terraces ran up against a lack of technical data (weight-bearing capacity) necessitating expensive additional studies, or, in the event of shortcomings (in terms of accessibility and permeability), requiring specific equipment to be installed. This is easier to factor in for new builds and urban renewal programs than for adapting older roofs. Equally, the diagnosis validated the fact that, in addition to roof terraces, the ground areas could at least partially meet residents' needs and expectations , even though there were few such areas and they did not initially look particularly favourable (due to their size and fragmentation). In urban agriculture, "land" is not just space on the ground, but also other spaces such as roofs, cellars, car parks, and so on.

57 In these three cases, institutional stakeholders' initial expectations, often leaning towards professional forms, were challenged by agri-technical constraints and the local stakeholders' requirements. The CCSEs and AFSDs provided a way of anchoring projects in the territorial and socio-economic context, while meetings with inhabitants and territorial stakeholders provided important information for better identifying consensual activities and those which sparked criticism or tension. Thus certain forms may be ruled out (at least provisionally as in Montrouge), or placed in a larger framework (concerning local farming in Bordeaux). New potential may also be revealed for populations, such as in Lille (due to their culinary know-how and interest in food processing), acting as potential resources for the project. It is clear that participatory forms of UA were of great interest in these three cases.

4.2. Timeframes and relays for applying METH-EXPAU®

58 The limitations encountered in applying our multi-phase method consists, first, in the time needed to gather all the data, including the survey phase with stakeholders in the territory. Additionally, some data, such as that relating to agri-technical characteristics, the weight-bearing capacity of roofs, or the chemical characteristics of soils, is expensive to obtain. Health risks (real, or suspected in the absence of data) leads to sites being ruled out, along with certain technical systems or activities.

59 Nevertheless, applying the method shows the benefits of conducting agri-technical studies well in advance so as to factor in site characteristics, including the level of soil contamination. For new development projects extending over long timeframes, diagnosis could be divided into two phases. The ATD needs to be conducted in detail—with the requisite time and funding—from the earliest stages of devising the UA project so as to identify the most suitable places for siting it given the chemical and agronomic qualities of the soil, perhaps including the possibility of conducting on-site experiments to measure the transfer of chemical elements to plants. The CCSE and

AFSD phases, for their part, may take place at various stages: provided most stakeholders are present, conducting them during the preconception phase provides a way of bringing out crucial contextual points. When the project is still a long way off, as in the case of Bordeaux, the fact that some actors are absent (in this instance, new inhabitants) means that the operation needs to be repeated once at least some of these new stakeholders are present.

60 Finally, in these three cases, the fact that the local authority did not have a single specific person designated for UA made it difficult to transmit information and build on work conducted during the diagnosis process. Indeed, several local authority services are concerned by such projects (green spaces, technical services, participatory democracy, etc.), and while their diversity is of great value during the TD, the fact that they frequently operate in silos makes it hard to implement and monitor projects. In the event of there being a nominated UA delegate within a local authority to establish links between services and support projects, this brings out the need to develop links with citizens.

5. Conclusion

61 In the current context in which local authority demand for urban agriculture is exploding, and with funding coming through for projects selected in the first ANRU "Quartiers Fertiles" (Fertile Neighbourhoods) call, launched in January 2020, it is a priority to implement solid methods to analyse context and support stakeholders. The multi-phase method presented here is intended to help meet this need. Applying the method in its full complexity consists in implementing a territorial engineering process seeking to identify and activate socio-territorial resources. The approach seeks to create a space of learning, both to provide public authorities with the keys for understanding the constraints and levers for setting up UA projects, and to trigger a process of co-construction with stakeholders in the territory. As shown in Chia et al. (2010), it is a matter of developing an idea of "continuous diagnosis" to be updated over the course of monitoring, and to be appropriated by agents. This multi-phase method could thus be used to define market gardening forms to be established in peri-urban areas. It would be interesting to test its capacity to address peri-urban forms of agriculture as they build up ever closer connections with towns.

62 The current abundance of public and private support for developing UA also heightens the imminent need for rafts of indicators to monitor projects. Research and action research will need to adapt them to the complexity of phenomena and of stakeholders: this is a future methodological challenge for Exp'AU.

BIBLIOGRAPHY

Aubry C., Daniel A.C., Nasr J., 2016, Organizing the Urban agriculture Movement: actors and networks in and around Paris, *in* R. Roggema (Ed.), *Agriculture in an Urbanizing Society volume Two, Chapter 45,* Cambridge: Cambrigde Scholar Publishing, pp. 1123-1140.

Baysse-Lainé A., Perrin C., Delfosse C., 2018, Le nouvel intérêt des villes intermédiaires pour les terres agricoles: actions foncières et relocalisation alimentaire, *Géocarrefour*, vol. 92, no. 4, [online] accessed 23 February 2019. URL: http://journals.openedition.org/geocarrefour/10417; DOI: 10.4000/geocarrefour.10417

Barbillon A., Aubry C., Manouchehri N., 2020, *Guide R.E.F.U.G.E. Caractérisation de la contamination des sols urbains destinés à la culture maraîchère et évaluation des risques sanitaires. Cas de la région Île-de-France*, [Research report] Paris: INRAE, AgroParisTech.

Charvet J.-P., Laureau X., 2018, *Révolution des agricultures urbaines: des utopies aux réalités*, Paris: Éditions France Agricole.

Chia E., Dedieu B., Deffontaines J.-P., Dorado G., 2002, Espace, exploitation, développement rural: proposition d'une démarche de diagnostic territorial (Argentina), *Cahiers Agricultures*, vol. 11, pp. 333-41

Chia E., Rey-Valette H., Soulard C., Michel L., Laurent A., 2010, Le diagnostic territorial? Un outil pour décider ensemble!, Colloque OPDE 2010 INRA Montpellier "Aide à la décision et gouvernance", 25-26 October 2010, Montpellier

Duchemin E., Wegmuller F., Legault A.-M., 2010, Agriculture urbaine: un outil multidimensionnel pour le développement des quartiers, *VertigO - la revue électronique en sciences de l'environnement*, vol. 10, no. 2, [online] accessed 23 February 2019. URL: http://journals.openedition.org/vertigo/10436; DOI: 10.4000/vertigo.10436

Duvernoy I., Barthe L., Lima S., 2012, Les représentations de l'activité agricole dans les projets de territoires périurbains: exemple de trois Pays en Midi-Pyrénées, *Norois*, vol. 224, pp. 49-60

Estival L., Musy M., 2017, *Vivons la ville autrement: des villes durables où il fait bon vivre au quotidien*, Versailles: Éditions Quae.

Genevois, S. & Carlot, Y., 2011, Les territoires du quotidien en France: approches possibles (et raisonnables) avec les TICE. Study day APHG, MCF in the didactics of geography and ICT for educational purposes, University of Cergy-Pontoise – IUFM de Versailles. Repéré à http://sgenevois.free.fr/Territoires

Giacchè G., 2016, De la ville qui mange à la ville qui produit: l'exemple des "Hortelões Urbanos" de Sao Paulo, *ESO Travaux & Document*s, [online] accessed on 10 December 2021 https://hal.archives-ouvertes.fr/hal-01483364/document.

Jean-Baptiste S., Guichard L., Reau R., Prost L., 2017, Co-construction d'un guide pour le diagnostic territorial des pressions et émissions agricoles, *Innovations Agronomiques*, INRA, vol. 57, pp.35-52.

Lardon S., Piveteau V., 2005, Méthodologie de diagnostic pour le projet de territoire: une approche par les modèles spatiaux, *Géocarrefour*, vol. 80, no. 2, [online] accessed 14 December 14 2017. URL: http://journals.openedition.org/geocarrefour/980; DOI: 10.4000/geocarrefour.980

Lelièvre A., Grard B., Aubry C., Saint Gès V., 2018, Agriculture urbaine en France, le jeu des sept familles. *The conversation*, 25 November 2018, [online] accessed 10 December 2021 URL: https://theconversation.com/agriculture-urbaine-en-france-le-jeu-des-sept-familles-107381

Mathieu N., 2017, *Les relations villes/campagnes. Histoire d'une question politique et scientifique*, Paris: Éditions L'Harmattan.

Magnaghi A., 2010, *Progetto Locale*, Torino: Bollati Boringhieri.

Morel-Chevillet G., (ed.), 2017, *Agriculteurs Urbains,* Paris: Éditions la France Agricole.

Pecqueur B., 2001, Qualité et développement territorial: l'hypothèse du panier de biens et de services territorialisés, *Économie Rurale*, vol. 261, pp. 37-49.

Poulot M., 2015, Agriculture et ville: des relations spatiales et fonctionnelles en réaménagement. Une approche diachronique, *POUR*, vol. 224, pp. 51-66

Rapion P., 1999, Une analyse localisée du développement économique: le diagnostic territorial, application à 2 petites régions du Massif Central, *Ingénieries – EAT, IRSTEA* no. 18, pp. 49-59.

Reghezza-Zitt M., 2015, Territorialiser ou ne pas territorialiser le risque et l'incertitude: la gestion territorialisée à l'épreuve du risque d'inondation en Ile-de-France, *L'espace Politique,* vol. 26, [online] accessed 21 June 2020, https://journals.openedition.org/espacepolitique/3543.

Senil N., Hirczak M., Hugues F., 2006, Diagnostic de territoire et ressources territoriales: apports croisés et opérationnalité. Workshop "Les dynamiques territoriales: quelles nouveautés?", I.R.E.G.E – E.D.Y.T.E.M, March 2006, Chambery-Amnecy, France.

NOTES

1. Defined as agriculture located in or on the outskirts of a town, producing for the town, and with close functional links to it (Moustier & M'baye, 1999; Nahmias & Le Caro, 2012)

2. This law was passed in the wake of national consultation about food issues (Etats-Généraux sur l'alimentation) and seeks to rebalance trade relations in the agricultural sector with healthy and sustainable food. This law has three objectives:

i. pay a fair price to producers, to allow them to live with dignity from their work;

ii. improve the health, environmental, and nutritional quality of products;

iii. promote healthy, safe, and sustainable food for all.

3. https://lesincroyablescomestibles.fr/ressources-ic/Charte-Fondamentale-IC.pdf

4. E.g., ANRU, 2019, Agriculture urbaine dans les quartiers en renouvellement urbain. Boite à outil du montage d'un projet, consulted in March 2020, https://www.anru.fr/sites/default/files/media/downloads/clubanru_guideagriurbaine.pdf; CEREMA et Exp'AU, 2019, Agriculture urbaine et Écoquartier, consulted in March 2019, URL: https://www.cerema.fr/fr/actualites/agriculture-urbaine-ecoquartier; Manterola B., (ed), 2016, Mon projet d'agriculture urbaine. Guide pratique des démarches réglementaires, DRIAAF, consulted in March 2019, http://driaaf.ile-de-france.agriculture.gouv.fr/IMG/pdf/Maquette_VF_cle475afb.pdf

5. Coordinated by the Exp'AU (Expertise en Agricultures urbaines) research services bureau, founded in 2015 as part of AgroParisTech Innovation, under the scientific supervision of members of the Agricultures Urbaines team (INRAE/AgroParisTech).

6. Several guides been produced to guide a specific diagnosis: e.g., Adivet, 2018, *Les premières recommandations techniques de l'agriculture urbaine en toiture*, consulted in May 2019, http://www.adivet.net/component/content/article/14-accueil/105-recommandations-techniques-aut.html; Ville de Paris, 2017, *Boite à outils de Parisculteurs*, https://www.parisculteurs.paris/data/

faq_47412/accueil/6/boite-a-outils-parisculteurs_d5ae1.pdf; Provent F., Mugnier P., 2020, *Agriculture Urbaine. Comment aménager une toiturre-terrasse. Guide pratique.* https://www.editions-eyrolles.com/Livre/9782416000140/agriculture-urbaine

7. https://sig.ville.gouv.fr/

8. The National Urban Renewal Programme 2014-2024 consists of operations to raze and rebuild, renovate, and rehouse inhabitants to improve housing, enhance the social mix, open up neighbourhoods, and stimulate economic development. This programme for city policy priority districts (QPV) is coordinated by the National Agency for Urban Renewal (ANRU).

9. APUR, 2013, *Etude sur le potentiel de végétalisation des toitures-terrasses à Paris,* 39 p., https://www.apur.org/fr/nos-travaux/etude-potentiel-vegetalisation-toitures-terrasses-paris

10. Glady V., Marion C., Morel A., 2018, Développer de l'agriculture urbaine dans la ville dense: l'exemple de Montrouge, Rapport Ingénieur. Dominante d'approfondissement IEVU 2017-2018. AgroParisTech (Paris)

11. A participatory budget consists in the municipality allocating some of its local investment expenditure (5% on average) to financing projects proposed and voted on by the inhabitants. In this way unelected citizens are involved in allocating public funds.

In detail: installing composters (11 proposals), community gardens (8 proposals), orchards (6 proposals), and planted roofs (4 proposals).

12. Morel A., 2018, Potentiel de commercialisation des produits d'agriculture urbaine à l'échelle d'une ville. Cas d'étude Montrouge. Mémoire fin d'étude, Spécialité IEVU. 2 greengrocers, 2 supermarkets, 1 organic shop, 3 food shops. Morel A., 2018, Potentiel de commercialisation des produits d'agriculture urbaine à l'échelle d'une ville. Cas d'étude Montrouge. Mémoire fin d'étude, Spécialité IEVU

13. Rungis international market is the largest fresh produce market in the world and is located south of Paris.

14. The Hauts-de-Seine department conducted an initial survey and identified 95 ha of land that was vacant or undergoing transition. Additionally, a platform was set up for all owners and managers of spaces of more than 200 m² to generate contacts with potential "project developers". The Métropole du Grand Paris and the Région Ile de France (which granted Montrouge a label in 2019) are also involved in developing urban agriculture.

15. Under this scheme, anyone may garden in public space on receiving approval from the municipality.

16. Information gathered via individual interviews carried out with local associations and a meeting to raise awareness, notably via photos, attended by thirty or so inhabitants.

17. Lille Métropole agricultural diagnosis, 2011

18. With plans for 2,000 low-density dwellings, individual houses, and small two- or three-storey blocks of flats.

ABSTRACTS

Over the past two decades, urban agriculture (UA) has boomed. A wide variety of forms have developed, from allotment gardens to UA rooftop greenhouses. Yet local authorities often struggle to define the specificities of the urban spaces and territorial dynamics involved. We propose a multi-phase method based on territorial analysis. This framework may be used to help

landowners select the most appropriate forms of urban agriculture in the light of overarching territorial characteristics. We have applied our method, stemming from an action research approach, to three case studies: the town of Montrouge, a priority district in Lille, and a new district in Bordeaux. These reveal its potential and its shortcomings. We demonstrate how the structural, technical, and social characteristics of the spaces and agents concerned can rule out certain forms of UA which do not correspond to the territory's (current) needs.

L'agriculture urbaine connaît un nouvel essor en France depuis une vingtaine d'années. Un large éventail de formes, des jardins familiaux urbains à l'agriculture en indoor ou sur les toits, se décline dans les territoires. Cependant les collectivités sont souvent démunies pour définir les formes d'agriculture urbaine au regard de la spécificité des espaces urbains dont elles disposent et des dynamiques territoriales qui les traversent. Nous proposons ici un itinéraire méthodologique, fondé sur le diagnostic territorial, permettant d'orienter et guider le choix des formes d'agriculture urbaine au regard des caractéristiques territoriales dans leur ensemble. Conçu et expérimenté dans le cadre d'un dispositif de recherche-action, cet itinéraire méthodologique a été déployé sur trois études de cas: la ville de Montrouge, un quartier prioritaire à Lille et un nouveau quartier à Bordeaux. Ces applications ont permis de tester l'itinéraire, d'en présenter le potentiel mais aussi ses limites. Nous montrons comment les caractéristiques structurelles, techniques et sociales des espaces et des acteurs concernés peuvent notamment conduire à exclure certaines formes d'agriculture urbaine qui ne correspondent pas, ou pas encore, aux besoins du territoire.

INDEX

Mots-clés: diagnostic territorial, agriculture urbaine, itinéraire méthodologique, METH-EXPAU®, recherche-action
Keywords: territorial analysis, urban agriculture, methodological framework, METH-EXPAU®, action research

AUTHORS

GIULIA GIACCHÈ

Coordinatrice Bureau de recherche et expertise Exp'AU, Université Paris-Saclay, INRAE, AgroParisTech, UMR SAD-APT, 16 rue Claude Bernard 75005, Paris, France, giulia.giacche@agroparistech.fr (corresponding author)

VÉRONIQUE SAINT-GÉS

Economiste et coresponsable scientifique d'Exp'AU, Université Paris-Saclay, INRAE, AgroParisTech, UMR SAD-APT, 16 rue Claude Bernard 75005, Paris, France, veronique.saint-ges@inrae.fr

YOANN DURRIEU

Chargé de mission Exp'AU, Université Paris-Saclay, INRAE, AgroParisTech, UMR SAD-APT, 16 rue Claude Bernard 75005, Paris, France, yoann.durrieu@gmail.com

MÉLANIE COLLÉ

Chargé de mission Exp'AU, Université Paris-Saclay, INRAE, AgroParisTech, UMR SAD-APT, 16 rue Claude Bernard 75005, Paris, France, melaniecolle01@gmail.com

CHRISTINE AUBRY

Agronome et coresponsable scientifique d'Exp'AU, Université Paris-Saclay, INRAE, AgroParisTech, UMR SAD-APT, 16 rue Claude Bernard 75005, Paris, France, christine.aubry@agroparistech.fr