

Growing food for self-consumption inside cities: lessons learnt from urban allotment gardens in Paris and Montreal

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Abstract: Allotment gardens are one of the most developed forms of urban agriculture in industrialized countries. They are highly multifunctional, and can have various names, status and modes of organizations from a country to another and inside a country. The food function of allotment gardens is a topic of interest for planners and for research; however, the actual quantity of food produced in allotment gardens is poorly known. We investigated the food function of different types of allotment gardens in Paris and Montreal using a methodology combining questionnaires and qualitative in-depth interviews, monitoring of gardeners cropping practices and weighing of fruits and vegetables harvested in the gardens. We observed different weights of food function depending on the type of garden investigated, combined with highly variable individual practices in terms of quantities harvested and yields. In order to explain in part this variability, we propose the notion of “utilized garden area”. We conclude with the necessity of exploring the individual determinants of garden food function, which imply understanding the multifunctionality of garden as perceived by gardener and the strategies behind the choices of gardeners and their management of their garden and harvest.

Keywords: allotment gardening, community garden, food function, food production

Diversity of garden types, diversity of food functions?

In industrialized countries, there has been a considerable renewed interest for urban agriculture (Aubry & Pourias 2013). In Montreal and Paris, allotment gardens is the most developed form of urban agriculture so far. Urban allotment gardens are urban forms of kitchen gardens managed collectively by a group of gardeners, most often with a family consumption purpose (non-commercial productions), located outside the place of residence of its members (Jassur 2013). Under the generic term “allotment gardens”, we gather together gardens that may have various names, status and modes of organizations from a country to another and inside a country (e.g. community and collective gardens in North America, shared gardens and family gardens in France etc).

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Table 1: Different types and names of urban allotment gardens in Paris and Montreal

Name	Definition	Extent
Community garden	A neighborhood garden in which individuals have their own plots, yet share in the garden's overall management (Lawson 2005). In Montreal, community gardens are administered by the Ville de Montréal and offer plots to individuals who grow and reap their own harvest.	Northern America mostly; 95 in Montreal in 2012
Collective garden	Collective gardens involve the pooling of many small garden plots, with all participants assuming joint responsibility [usually under the coordination of a garden supervisor]. Collective gardening is distinguished from community gardening by the fact that it is practiced by groups of people who grow a vegetable garden together instead of each person tending their own individual plot (Centraide s. d.)	Quebec ²⁹³ ; 77 in Montreal in 2012
Shared gardens	Gardens mostly located within the city of Paris, and dedicated to be grown by a group of citizens, most of times people that live in the very close neighborhood. The plots can be grown communally or be individual plots	Exact number unknown in the Ile-de-France region; 122 in Paris in 2013
Family gardens (former name: worker's garden)	Garden, in which families tend their own plots, yet share in the garden's overall management. In the Parisian region, they are the successors of 19 th century "worker's gardens".	Exact number unknown in the Ile-de-France region ; 2 in Paris in 2013

In Montreal, in 2012, there were 95 community gardens and 77 collective gardens, which covered around 27 hectares. In Montreal, all plots in community gardens are between 15 to 18 m². Two exceptions may exist: when gardeners grow a half-plot (that's often the case for beginners, who eventually evolve to garden a whole plot) and when gardeners grow in containers.

In the Ile-de-France region (region of Paris), the exact number and area covered by allotment gardens is poorly known. An inventory is in progress to give a more accurate view of the extent of allotment gardens in the region. What we already know about Parisian gardens is the huge variability of their modes of organization (individual vs communal plots, size of the plots: in the Ile-de-France region, plot sizes can range from 2m² to 500m²), denomination and status. Many different names exist: *jardins partagés*, *jardins d'insertion*, *jardins collectifs*, *jardins solidaires*... The name that the group of gardeners has chosen to refer to its garden is meaningful, but it doesn't refer to a fixed category. However, to simplify, we will distinguish to main categories of gardens in the Parisian region: **shared gardens**, which is the most important type within the city of Paris as their number grew rapidly for the past decade (they were 5 in 2003, they are now more than 120); and **family gardens**, which are predominant in the suburbs of Paris.

Allotment gardens fulfill a high diversity of function (Duchemin & Wegmuller 2010). Their social and recreative functions are well known, and the importance of their food function, i.e. the importance of garden productions in gardeners' food supply, and, beyond that, for cities food security is an interesting topic for scientific research and for city planners. However, as Gittleman (2012) pointed out, "the quantity of food produced in [allotment gardens] remains unknown", despite a few studies led in the USA that gave first figures on food production in urban gardens (Boston Natureal Areas Network 2009; Vitiello & Nairn 2009; Gittleman et al. 2012).

We hereby propose to quantify (levels of production) and qualify (importance of garden production in overall diet) this food function by exploring gardeners' own assumption of the food function of their garden, their cropping practices and the actual quantity of fruits and vegetables harvested in the gardens. Considering the high diversity of types of garden that may exist under the generic term "allotment garden", we assume that the levels of production and therefore the importance of garden produce in gardener's diet will vary according to garden types.

²⁹³ The same word exist in France but doesn't refer to the same thing; in France, "collective garden" is the translation of the generic term "urban allotment garden")

Methodology

Sites

We worked in 15 gardens: 10 in Paris region, 5 in Montreal. They were chosen in order to represent a variety of situations in terms of geographical location, modes of organizations (individual vs communal plots, size of the plots; Table) and status (in Paris, family and shared gardens were investigated; in Montreal, only community gardens were investigated).

Table 2: Recap chart of investigated plot per garden and their sizes

City	Garden	Type of garden	Location and main features	Gardener	Size of the plot
Paris and parisian region	Bd de l'hôpital	Family garden	Family garden located in the 13th <i>arrondissement</i> of Paris, at the foot of social housing buildings; created in 2000, 26 individual plots of 15 to 25m ²	BH_AD	28
				BH_Alb	25
				BH_And	25
				BH_Dan	30
				BH_J	30
	Jardin des Bordes	Shared garden	Shared garden located in a nature reserve in the department 94 (outside Paris); created in 2004; 49 plots of 78 to 196m ² , 2 collective plots of 500m ²	BO_A	75
				BO_Ant	70
				BO_MO	129
				BO_P	129
	Jardin de l'AJOAC	Family garden	Family garden located in the department 92 (outside Paris); created in 1942; 290 plots of 100 to 200m ²	CL_B&J	200
				CL_E	200
				CL_TB	178
	ECOBBOX	Shared garden	Shared garden located in the 18th <i>arrondissement</i> of Paris on a parking lot, entirely in containers; created in 2009, around 20 semi-individual plots of 2m ² built on pallets + containers	ECO_M	6
				ECO_B	4
ECO_S				2	
Jardin de la Pointe de l'Île	Family garden	Family garden still referred by gardeners as "worker's garden" located in the department 92 (outside Paris) on an artificial extension of an island; created around 1980; 15 individual plots of 500m ²	ILE_C	91	
			ILE_FG	391	
			ILE_Bat	101	
			ILE_LP	300	
Jardin aux habitants	Shared garden	Shared garden located in the 16th <i>arrondissement</i> of Paris, on a street; created in 2001 by an artist, Robert Milin; 13 plots of 20 to	JH_Aa	15	
			JH_MM	22	
Le Sens de l'Humus	Shared garden	Shared garden located in the departement 93 (outside Paris), located on the heritage site of the "Murs à Pêches", a former site of fruit production; created in 2006, one collective plot of 500m ²	HUMUS_PZ,F,L,J	Collective plot, 500m ²	
Jardin de Perlimpinpin	Shared garden	Shared garden located in the 17th <i>arrondissement</i> of Paris, in a park; created in 2008; around 30 plots of 5m ²	DEPE_H, L, MD, S	3	
Jardin partagé Choisy	Shared garden	Shared garden located in the 13th <i>arrondissement</i> of Paris, in a park	EN,H,CH, OC,NC,OS	4 collective plots of 16m ²	
Dalle Hannah Arendt	Shared garden	Shared garden located in the department 93 (outside Paris), on a rooftop; initially gardened by a community of women from Mali	AFMM	10	
Montreal	Basile-Patenaude	Community garden	Community garden located in the district Rosemont Petite-Patrie; 76 individual plots of 18m ² ; 9 plots attributed to a collective garden	BP_A	18
				BP_D	18
	George-Vanier	Community garden	Community garden located in the district Ville-Marie; 700m ² ; individual plots of 18m ²	GV_E&D	18
				GV_F	18
				GV_M	18
				GV_N	18
				GV_R	18
	Lorimier	Community garden	Community garden located in the Plateau district; 5257m ² ; individual plots of 18m ²	LO_C	18
				LO_L	9
				LO_Lu	18
	Pointe-Verte	Community garden	Community garden located in the Pointe St Charles district; 746m ² ; individual plots of 15m ²	PV_Fa	15
PV_G				15	
PV_S				15	
PV_S&B				15	

In both cities, gardens that were only dedicated to flower production - which is an unusual case but might exist – were excluded. The sample of gardeners interviewed was chosen randomly.

Semi-directive interviews

54 gardeners were interviewed in Paris in 2011 and 2012, 16 in Montreal in 2013.

These semi-directive interviews took place at the beginning of the growing season (March to beginning of May in Paris, May in Montreal) and lasted between 30 minutes and 1h30. Gardeners were asked about (i) their frequentation of the garden (time spent at the garden, distance to home, visits at the garden alone or with other persons...) and the functions they attributed to the garden, (ii) the importance of the overall food function of their garden, the destinations and modes of consumption of their harvests and the importance of the garden produce in their diet, (iii) their cropping practices (crop organization, work organization, techniques and source of their know-how).

Harvest books

At the end of the interview, if gardener volunteered to continue the study with us, he/she was given a weighing scale and a harvest book. The harvest book consisted of 12 pages of blank tables with the following headings: (i) crop (with the name of the variety when known), (ii) date of the harvest, (iii) quantity harvested (number of units or weight), (iv) type of preparation (was the harvest eaten raw, cooked or preserved?) and (v) destination of the harvest (who ate it?). The harvest books were distributed among 19 gardeners in Paris in 2012 and 2013, and among 14 gardeners in Montreal in 2013. At the end of the season, we were able to collect 14 filled books in Paris in 2012, 9 in 2013 and 13 in Montreal in 2013.

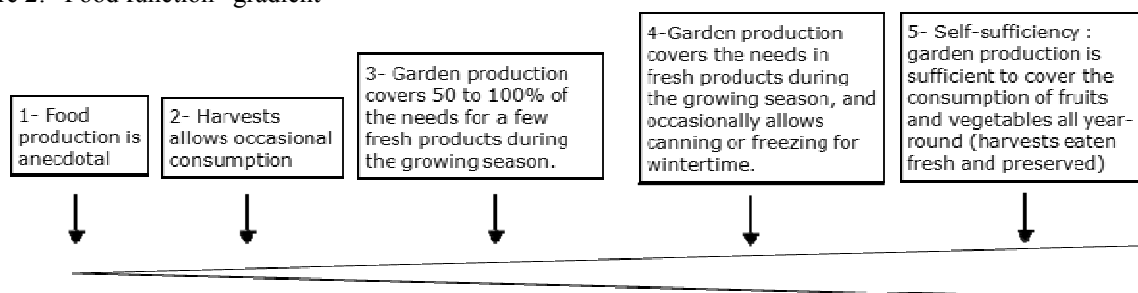
Monitoring of the plots

Every month during the growing season (in 2012 and 2013 in Paris, in 2013 in Montreal), the plots of the gardeners to whom we distributed the harvest books were monitored. Each time, a plan of the plot was drawn and newly planted areas and crops in the process of being harvested were written down. Gardener was asked to describe his/her plantings, and the reason why he/she planted the new crops. He/she was also asked about potential pest or diseases problems, and any inputs he/she might have brought to the garden were recorded (including pesticides and fertilizers). We also checked that he/she had no problem with filling up the harvest book, and noted down any other remark he/she might had regarding his/her harvests and his/her garden.

Survey

At the end of the 2013 growing season, to complete the assessment of the gardens food function by gardeners, a questionnaire was distributed to all gardeners of the 15 gardens sampled, plus to 15 other gardens in Montreal. In this questionnaire, gardeners were asked to tick the case that best described their situation regarding the food function of their garden on a gradient. This theoretical gradient was designed on the basis of the 2011 and 2012 interviews (Figure 2).

Figure 2: “Food function” gradient



The main interest of this gradient is to allow each gardener to be situated with respect to the others. It provides a set of situations that covers almost all of the ways the garden can contribute to the gardeners' diet by providing fresh fruits and vegetables.

However, this gradient has limits: first of all, it does not give information on the overall proportion of fruits and vegetables in the diet of gardeners. A garden with a given production will cover more easily the needs of someone that eats very few fresh produce than someone that eats a lot of fruits and vegetables. Secondly, the cases presented in the gradient remain deliberately imprecise. They reflect a qualitative and subjective appreciation by the gardener of the garden food function. Thirdly, this gradient leaves out some particular strategies of "management" of the garden produce that were observed during the investigation, for example: (i) the gardener doesn't eat his/her produce during summertime; he/she buys fruits and vegetables during the growing season, when prices are low on the market and preserve his/her harvest for wintertime; (ii) the gardener doesn't grow anything in the garden that can be bought, he/she only grows rare and original produce that he wouldn't buy in shops. The garden produce is considered as "fresh delicatessen".

It should be pointed out that all these strategies (those included in the gradient and those described above) were observed in the sample of gardeners interviewed. However, they never came alone, but mostly in combination. For example, a gardener (BP_A) in a community garden of Montreal, native of Cameroun, grew radishes and tomatoes that she ate during summertime with her daughters and green leaves used to cook green sauce (spinach, amaranth, swiss chards...) that she froze and kept for wintertime, when they have a high price in shops. On the contrary, another gardener in a shared garden of Paris (BH_AD) grows mostly produce that she wouldn't find in shops or that are expensive (potato "ratte", dandelion, lovage...) and a lot of lettuces that she found flavorless in shops and markets. She consumes all her harvest during summer.

In this article, we won't detail the results of the semi-directive interviews regarding the frequentation of the garden and the functions attributed to the garden, nor the cropping practices. We will focus on the appreciation of the food function by gardeners, mostly through the presentation of the "garden food function gradient" survey, with the help of examples taken from the interviews. We will then compare this appreciation with the measure of the production (results of the harvest books).

Similarly, we will only use the results of the plots monitoring to take a look at the areas dedicated to grow the various crops. These areas will allow us to present and discuss the yields achieved by the gardeners involved in the study.

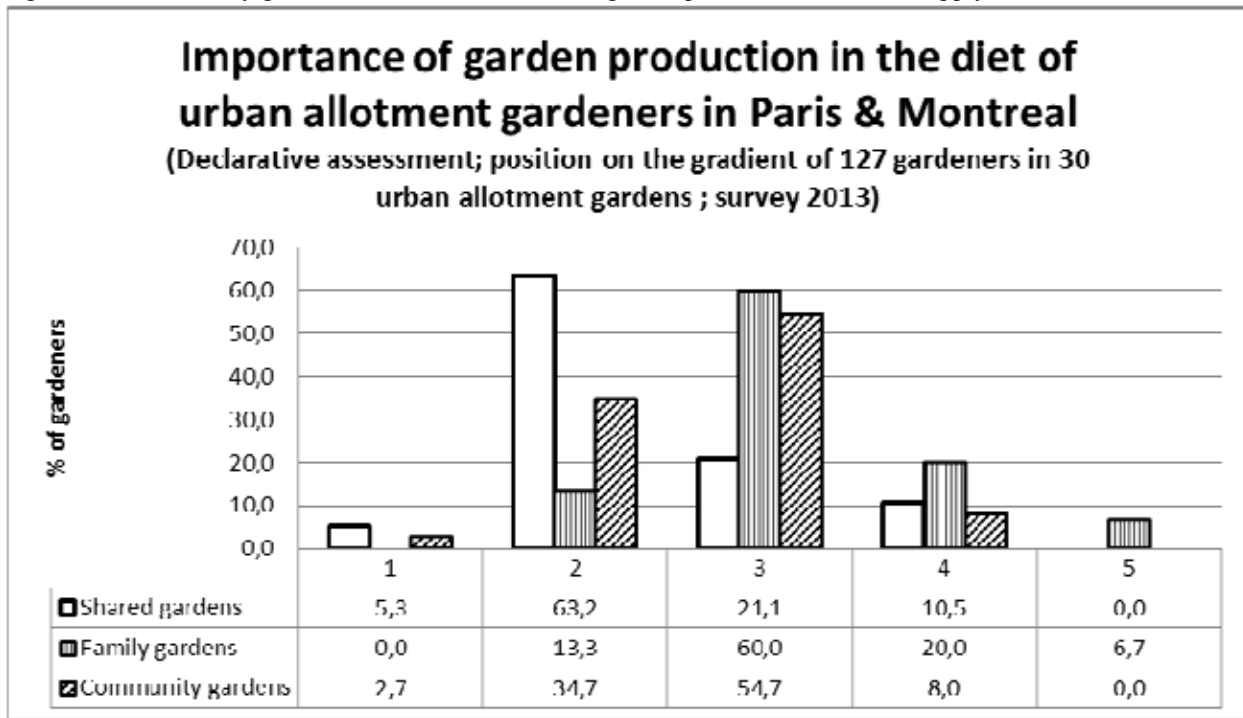
Results

Evaluation by gardeners of the importance of garden production in their diet

In Paris, most gardeners in shared gardens identify themselves to cases 2 (63,2%) and 3 (21,2%). In family gardens, gardeners identify themselves to cases 3 (60%) and 4 (20%) (Fig. 3).

In Montreal, community gardeners mostly identify themselves to cases 3 (54,7%) and 2. (34,7%) (Fig. 3).

Figure 3: Evaluation by gardeners of the contribution of garden produce to their food supply



It appears that the food function has a different weight depending on the type of the garden, as food production in shared gardens, according to gardeners, seems to contribute less to the diet of gardeners than in family and community gardens.

This general trend can easily be explained by looking at the historical and regulatory context of urban allotment gardens, which differs significantly from one type to another. In France, family gardens are the successors of 19-th century “workers’ gardens”: they were designed to offer sites for food production for workers, and the rules that apply to the gardens still mention today that the plots should be dedicated to food production; the plots are also relatively big. Shared gardens are more recent, and were initiated with various objectives, that included education purposes, revitalization of neighborhood life... Their food function is therefore more rarely put forward, while plots are often smaller than those in suburban family gardens. In Montreal community gardens, rules that apply to the gardens resembled to those in French family gardens as they also encourage food production but plots are smaller.

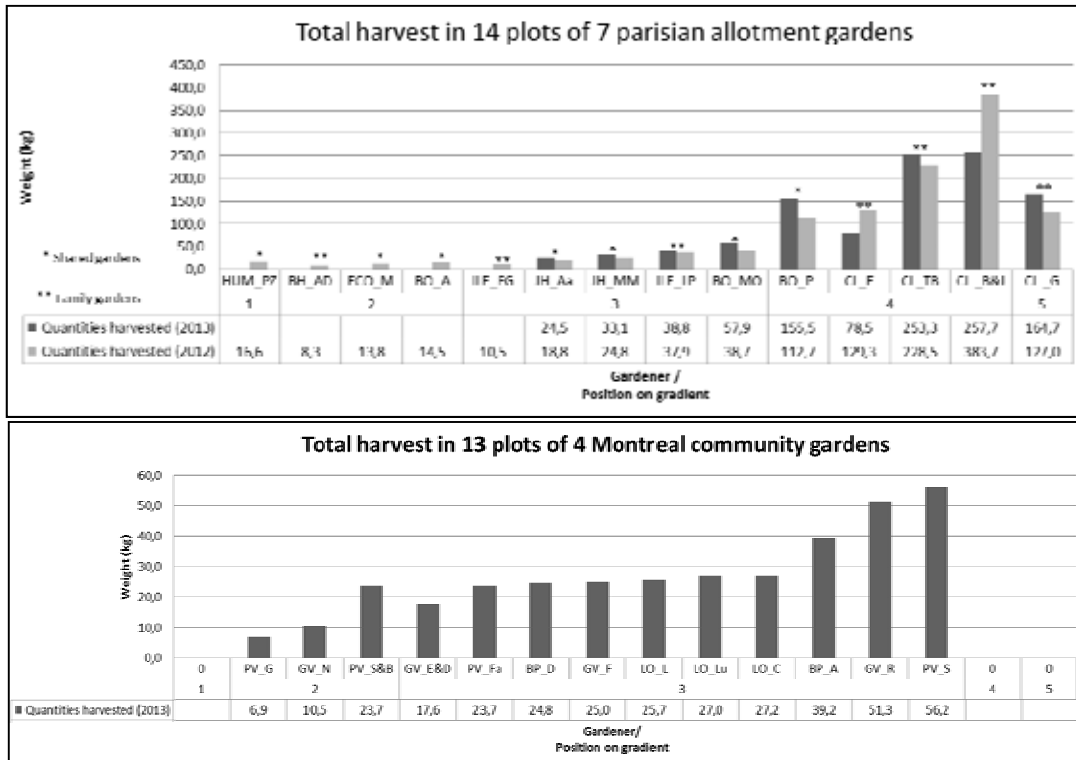
However, as we will see, behind these general trends hides a high diversity: individual practices might differ significantly from one gardener to another.

Quantities produced in gardens

The quantities of fruits and vegetables harvested in the garden were obtained through the harvest books. While not reflecting the diversity of crops and the individual preferences of gardeners or the volumes produced, they allow to represent different levels of food production in the investigated plots and to compare them with the estimated levels of contribution of the garden to gardener’s diet (Figure 4).

In Paris in 2012, the quantities harvested during the growing season ranged from 8,3 kg total for a 28m² plot in a family garden within Paris (BH_AD) to 383,7kg for a 200m² plot in a suburban family garden (CL_B&J). In 2013, the figures remain consistent with those obtained in 2012. The quantities harvested ranged from 24,5 kg harvested on a 15m² plot in a shared garden within Paris (JH_Aa) to 257,7kg harvested on the same 200m² plot (CL_B&J). In Montreal in 2013, the quantities harvested ranged from 6,9 kg (PV_G) to 56,2kg (PV_S) on two plots of 15,4m².

Figure 4: Quantities of fruit and vegetables harvested in Parisian and Montreal gardens in 2012 and 2013 and position of gardeners on the “food function” gradient



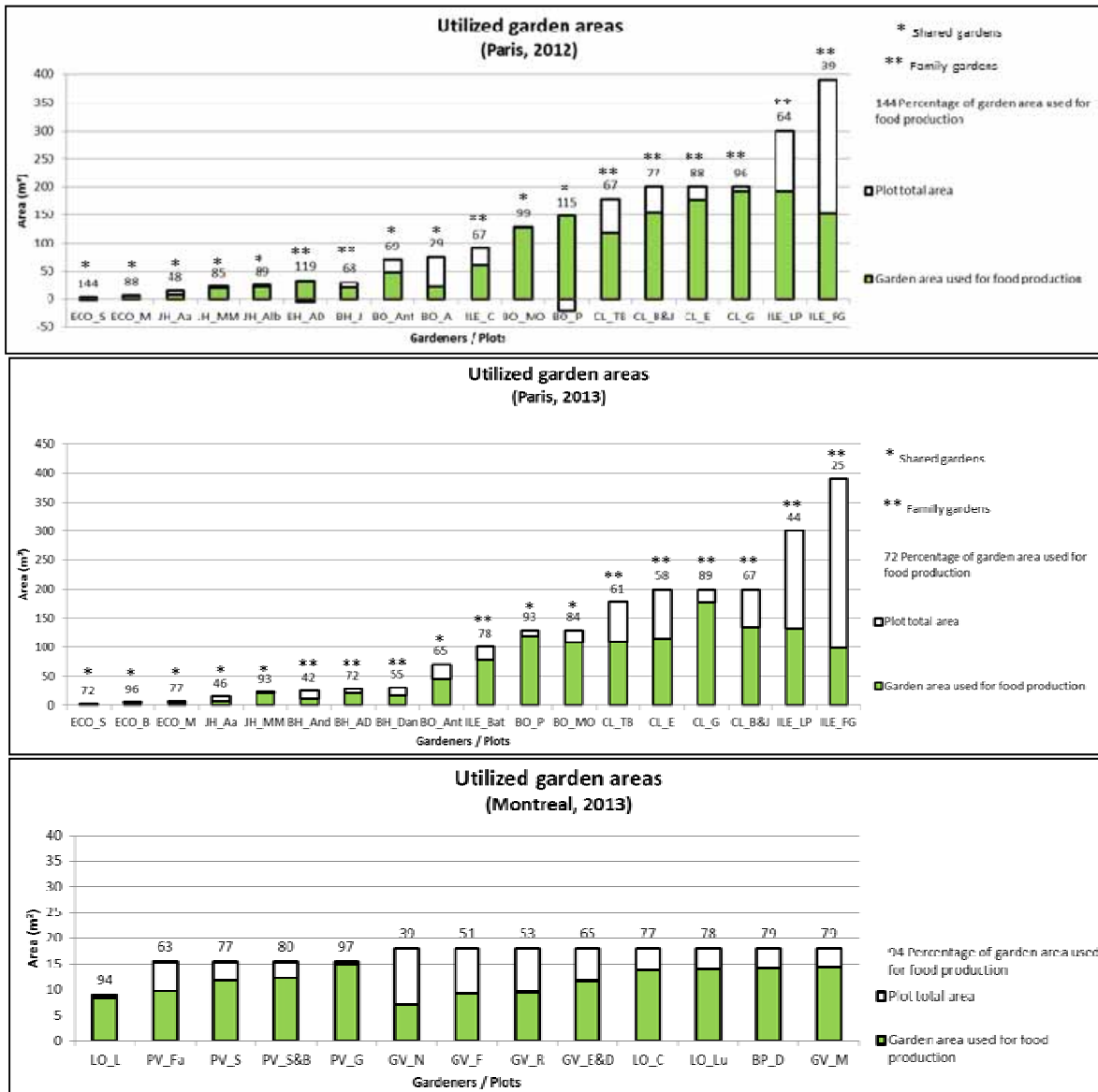
A first result is that the estimated contribution of the garden to the diet (situation on the gradient) is very consistent with the quantities harvested. Gardeners that identify themselves in situations 1 or 2 grew between 6,9kg/year to 16,6 kg/year. Gardeners that chose situation 3 grew between 17,6 kg/year to 57,9 kg/year. Gardeners that chose situation 4 or 5 grew between 78,5kg/year and 383,7kg/year.

A second result is that we observe a great variability in the amount of fruits and vegetables harvested per gardener that can only be partly explained by the size of the plot. The following part of the results will help us to better understand the determinants of this variability.

Utilized garden area

The “utilized garden area” was calculated as follows: all areas under cultivation per crop were taken from the plans drawn monthly and added up. All permanent or temporary paths (including paths between two beds), areas planted with flowers and lawn, cabins and toolboxes were considered as non-cultivated areas.

Figure 5: Percentages of plots used for food production



The percentage of the plot dedicated to food crops varies greatly from one gardener to another (Fig. 5). This can be explained by the allocation to a part of the garden to other crops than food crops and to the presence of areas dedicated to other activities than growing plants. This has to be considered in relation with the multifunctionality of allotment gardens.

In Paris, the variation from one year to another on a same plot can be explained through two factors of variation. First of all, the general trend of decrease in cultivated area from 2012 to 2013 can be easily explained by the weather conditions: the growing season began much later in 2013 than in 2012, due to the exceptionally cold spring. Secondly, the personal history of gardeners is also in some cases an explanatory factor. For example, in 2013, one parisian gardener (ILE_LP) had family troubles which led him to travel at the end of the summer, preventing him from planting as much cabbages as he did in 2012, which is one of the main crop of his garden. Similarly, another gardener learnt in 2012 that the soil of his garden presented metallic contamination problems (ILE_FG). Because he feared contamination of his produce, he reduced his activity of gardening and his production of food crops.

Yields

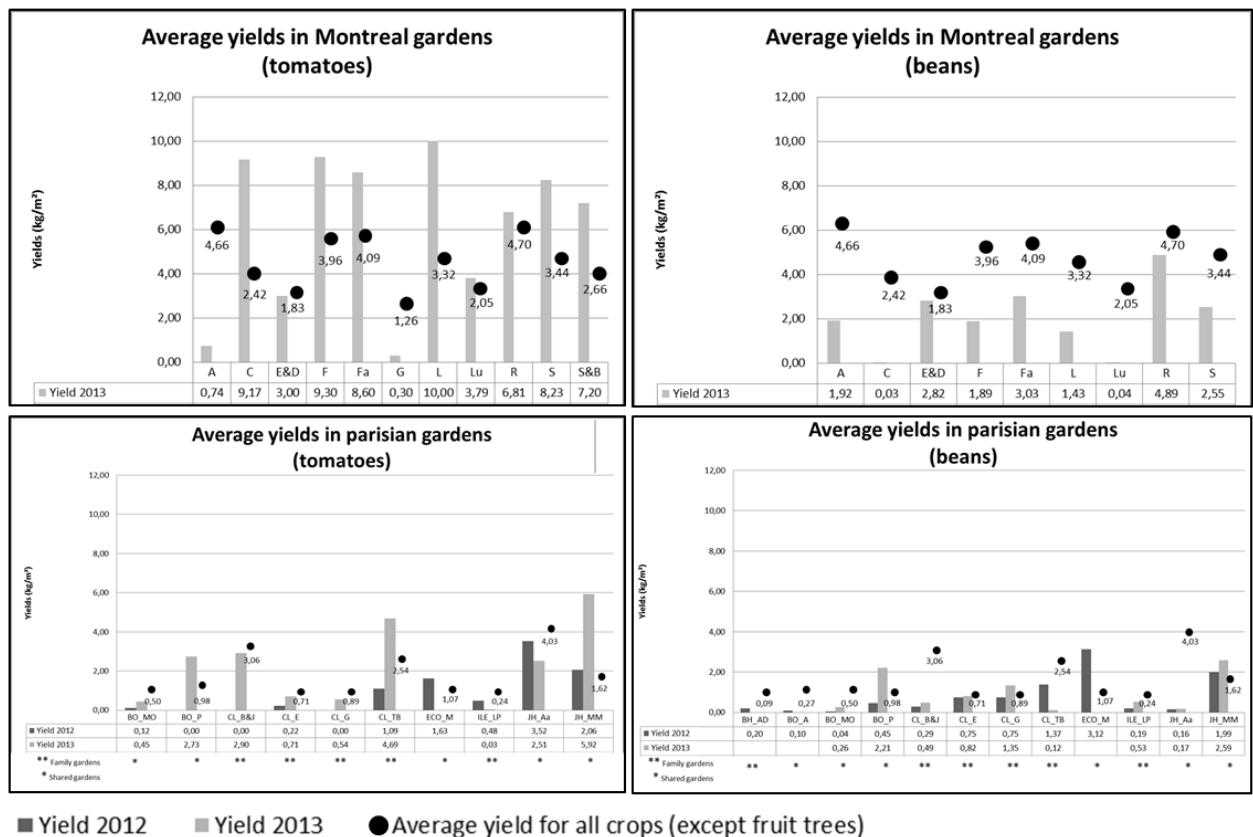
The following graphs show the yields for tomatoes and beans, which are in both cities among the first 5 crops grown in terms of weight (all investigated plots put together).

The average yield is the average of individual yields for all crops grown in one plot. Each individual yield is calculated as follows:

$$\sum_{i=1}^x \left(\frac{\text{total weight harvested during the season for crop } i}{\text{total area grown with crop } i} \right).$$

Therefore, this calculation doesn't take into account the potential loss of space due to the presence of lawn, cabins etc. In other word, the yields presented below are the yields for the utilized gardening areas. Fruit trees were taken out of this calculation, as they are forbidden in some gardens and caused significant differences in yield calculation.

Figure 6 : Average yields for three first crops (in weight) grown in allotment gardens of Paris and Montreal



Yields are very variable from one gardener to another, depending on the crop considered (Fig. 6). For example, for tomatoes, yields range from 0,30kg/m² to 9,30 kg/m² in Montreal and from 0,12 kg/m² to 5,92 kg/m² in Paris.

This is mostly due to the great variability of cropping practices that exist among non-professional gardeners. For example, the supply in fertilizer can range from no supply or very little supply of fertilizer (ex.: ILE_LP, brings only compost once a year) to a substantial supply of organic and chemical fertilizers of different kinds (ex.: CL_B&J brought in 2013 7 bags of 40l of fertilized potting mix, 4 wheelbarrow of manure and 30L of black soil, 2kg of specific fertilize for strawberries, 2k of specific fertilizer for tomatoes and a 25kg of general fertilizer for other crops).

In Paris, from 2012 to 2013 a general trend of increase in the yields can be observed. This can be explained by the different weather conditions between the two years. Given that we only took into account the yields for actual cultivated areas, we observe higher yields in 2013 as the end of the season was warm and favorable to crops. However, as the season started late, there was less rotations and we observe lower overall quantities harvest (cf. 2).

Discussion

While investigating allotment gardens food function, we deal with highly variable crop production systems. Even if general trends can be observed that differentiate one type of garden from another, gardeners' practices are far from being homogeneous.

Few gardens provide a complete self-sufficiency to their gardener, but most of them do play a role in the gardener's food supply, with various situations and various combinations of harvest management strategies.

In terms of quantitative production, we observed a high variability in quantities harvested per year. The size of the plot, of course, is a limiting factor but in order to explain this variability, it doesn't appear to be a good criteria in itself, as it has to be taken back to the actual area dedicated to food production in the plot. This "utilized garden area" is highly variable from one gardener to another. This variability has to be taken in relation with the already described multifunctionality of the garden (Duchemin et al.) and with existing rules that influence the use of land in allotment gardens (a certain percentage of the garden might be compulsorily dedicated to food crops). In other words, it depends on the place of the food function in the hierarchy of functions that the gardener assigned to the garden and to external constraints that may exist in certain types of gardens.

Therefore, the quantitative contribution of garden produce to gardener's food supply (in terms of weight of food produced per year) is firstly due to the gardeners' strategy (functions assigned to the garden) that is visible in the area allocated to food production and in the cropping practices of gardeners (choice of crops and fertilization and phytosanitary practices).

These cropping practices are also very variable. They depend on the gardener's know-how and personal history, but also, once again, on the rules of the garden (certain crops might be forbidden, ecological cropping practices might be required...). The performance of gardening systems is reflected in the average yields. The yields may also allow future comparisons with other crop production systems, including professional market-gardening systems. For example, in conventional market-gardening, the yields for tomatoes production are reported to range between 1,9 and 3,3 kg/m² (Weill & Duval 2009). In the allotment gardens that we investigated, the yields ranged between 0,12 to 17,25 kg, with an average of 3,4kg/m² (all plots, all years together).

The measurement of quantities produced per year is a tricky task. It requires a strong involvement of the gardener throughout the season: weighing and noting down every harvest is a tedious task. Furthermore, the particularity of allotment garden is that they are often located in a densely urbanized environment, surrounded with pathways and sometimes almost completely open on the street nearby. In such conditions, the stealing of fruits and vegetables is frequent. It's irritating for some gardener, its "part of the game" for other, but it almost always exists and is difficult to quantify. Furthermore, giving fruits and vegetables from the garden to a friend or a colleague as a present is very common. Thus, between the harvested quantity and the quantity actually consumed by the gardener, there is no direct relation: it's important to know how much of the harvest is given out of the gardener's close family.

However, if the information sought is only to know how much the garden contributes to the gardener's food supply, an interesting point is that the empirical estimation by the gardener is a reli-

able information that reflects the overall quantities harvested during the year and is consistent with the national average of fruit and vegetable consumption. In 2013 in Paris, the average total production for gardeners that chose case 4 (“Garden production covers the needs in fresh products during the growing season, and occasionally allows canning or freezing for wintertime”) and 5 (“Self-sufficiency : garden production is sufficient to cover the consumption of fruits and vegetables all year-round”) was 182 kg. The average quantity of fruits and vegetables (not including potatoes) bought by a family in France is around 167,9 kg in 2012 (France Agrimer et al. 2013).

In this respect, the “food function gradient” appears to be an interesting tool. However, it doesn’t reflect particular strategies that can only be understood through in-depth interviews.

Conclusion

As shown in this paper, differences in the food function weight can be observed between different types of garden. This can be explained by looking at historical and regulatory context of each type of garden. However, individual behaviors are very variable and don’t always reflect general trends. In family gardens, very “low intensive” use of space were observed, while in small plots in shared gardens, very high intensive use of space were observed. Further research should be dedicated to investigate the individual determinants of the use of space, and how these individual determinants cross with regulatory frameworks that apply to the gardens.

Furthermore, this paper focused mainly on the quantitative food function of allotment gardens: how much is produced, with which yields, how they contribute quantitatively to the gardener’s diet... Meanwhile, many questions arise regarding the qualitative food function of the garden. How the fact of gardening influences the consumption of fruits and vegetables, what is the quality of the produce of the garden compared with fruits and vegetables on markets or supermarkets, how gardens may allow certain persons to access fruits and vegetables that are not delivered in standard grocery stores (for example immigrant people) ... Are questions that still need to be discussed. Recent studies in the US showed that participating in a community garden influenced positively fruit and vegetable intake (Litt et al. 2011) and that gardeners had healthier diet than non-gardeners (Alaimo et al. 2008). The interviews that we carried out show evidence of “food strategies” related to how the gardeners see the potential contribution of the garden to their diet and how they manage their harvest: these “food strategies” related to gardens is an open-ended question that will have to be further discussed and put in relation with the functions assigned to the gardens.

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