

# Soil contamination in kitchen gardens of urban areas: the need for comprehensive approaches

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## INTRODUCTION

Urban agriculture and green infrastructures have been spreading worldwide in recent years. Besides food production, urban agriculture would contribute to ecosystemic services, and human health and well-being, through physical activity, healthy food consumption, stress reduction, and development of social contacts. Methodological frameworks are needed to link urban green areas, ecosystem and human health issues.

## OBJECTIVES

The Urban Soil Project aimed at studying relationships between socio-economical drivers of collective urban gardening, agronomical practices, soil quality, ecosystemic services and disservices and human health in some gardens of western Europe. We present the first results of the field work (soil characterisation and questionnaire survey) and stress the need for comprehensive consideration of the various issues in the decision-making processes about urban agriculture development.

## METHODOLOGY

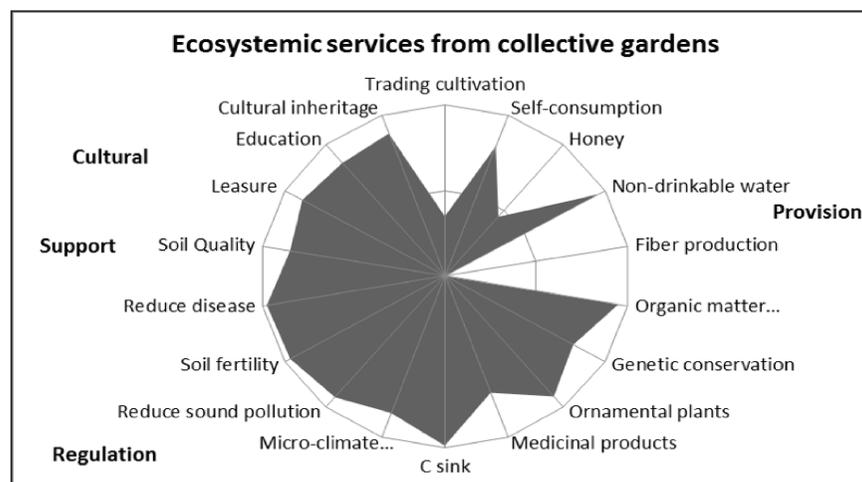
The general methodology consisted in selecting study cases, surveying soil quality and gardeners view, gathering information in a database, producing status reports and analysing links between data in order to assess services and disservices of gardens.

Four study cases were selected according to the importance of collective gardening and of former or present industrialization of the urban centers and also depending on project feasibility: Brussels, Paris, Manchester and the Walloon region, which included two main industrial cities (Liège and Charleroi) and some smaller cities.

Gardens and plots within gardens were selected on a voluntary basis. Questionnaires were built in order to survey motivations, practices and feelings of gardeners about their activities and the environmental issues of urban gardening. Interpretation

Metals	VR	VS	VI	> VS (%)	> VI (%)
As	12	49	300	0	0
Cd	0,2	3	30	3	0
Cr	34	125	520	0	0
Cu	14	110	290	5	1
Hg	0,05	1	6	9	0
Ni	24	150	300	0	0
Pb	25	200	700	17	2
Zn	67	230	710	18	4

**Table 1:** Interpretation values for metal contamination (total content in mg/kg): VR = reference value indicative of natural natural levels, VS = level above which a risk assessment is needed, VI : intervention value above which remediation operations should be implemented. Proportion of plots higher than thresholds



**Fig. 1:** Assesment of ecosystemic services from collective gardens in Wallonia and Brussels on a scale from 0 to 100 (log scale) according to answers to questionnaires and soil analysis

grids of the questions were also built. Fields were visited and soil samples taken by our team while questionnaires were either directly filled in during the visit or left to gardeners who had to send it later. Soil analysis were performed according to standardized protocols.

## MAIN RESULTS

### Soil Quality

The results for soil fertility indicate usually a pH close to neutral and high levels of organic matter and available nutrients. Differences of soil properties were very high between gardens and between study sites. Imbalanced

cation ratios were numerous, indicating lack of knowledge from gardeners related to soil and agronomical practices. Whatever the study case considered, the soil quality reflected the intensive nature of fertility management by gardeners which produce crops on small surfaces.

The soil contamination status is given in table 1. Variation is important according to origin of contamination (industries or gardeners practices). At some places, a detailed risk assessment had to be done. One of the most crucial metal was Pb content. *Gardens and gardeners* Most of gardens surveyed in Belgium were rather recent (<10 years).

They cover a surface smaller than 5,000m<sup>2</sup> and usually include less than 15-20 plots. The social aspect of the project is important. Urban gardeners in collective gardens are diverse but dominantly from higher education, either active or retired, male or female. 1:3 does not till the soil. They widely follow regulations of organic agriculture.

### Services and human health

Despite the potential disservices of gardens to environment due to over-fertilization and to human health due to soil contaminations, the gardens fulfill a lot of ecosystemic services: production of food, climate regulation, soil structure improvement, health benefits of physical activity, social links... A semiquantitative assesment (fig.1). shows the importance of services other than food production as well as health benefits.

## CONCLUSION

Our study focussed on collective gardens in urban environment in Wallonia, Brussels, Paris and Manchester. Through a questionnaire and soil survey, we got insights on the relationships between drivers of gardening, agronomical practices, state of soils and perceptions. It is clear that an approach based on a qualification of soils based on comparisons to environmental threshold values is not sufficient as social and health benefits are real even if they are difficult to quantify.

The URBAN SOILS Project was financed by Public Administration of Wallonia and French Administration through the SNOWMAN network. Should they find here the thanks from the authors of this paper. We also want to thank every people from gardens and associations who gave a bit of their time in order to help us to gather data from the field



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2 - 4 MAY 2018 | FAO - ROME, ITALY