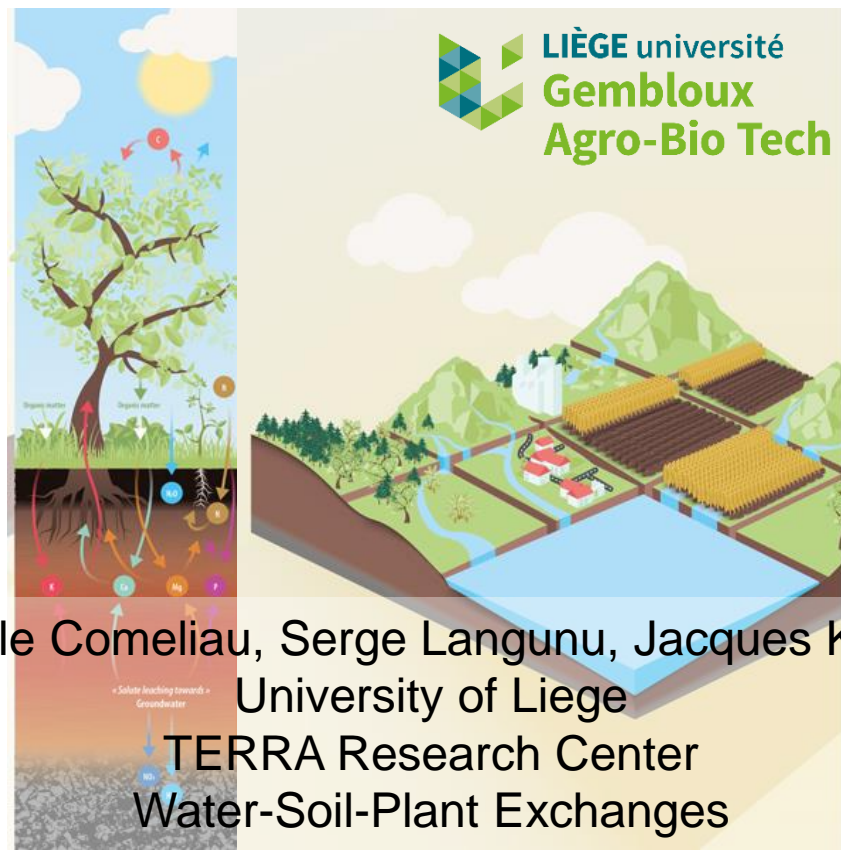
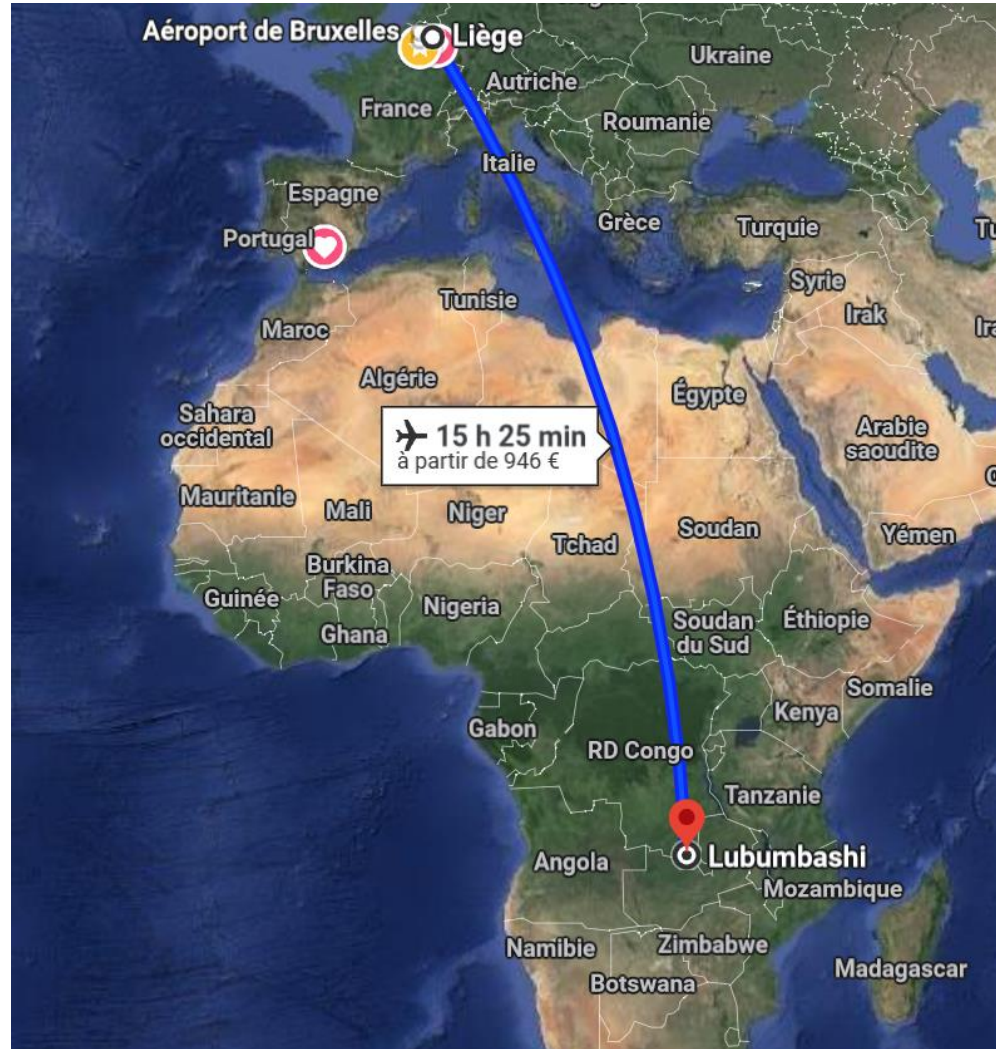
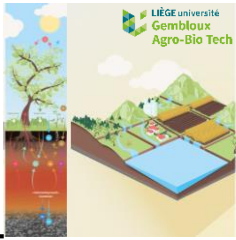


Growing vegetable crops in urban and periurban metal contaminated soils : insights into Liege (Belgium) and Lubumbashi (RDCongo) realities.



Gilles Colinet, Sibylle Comeliau, Serge Langunu, Jacques Kilela, Mylor Shutcha
University of Liege
TERRA Research Center
Water-Soil-Plant Exchanges

Context



Lubumbashi

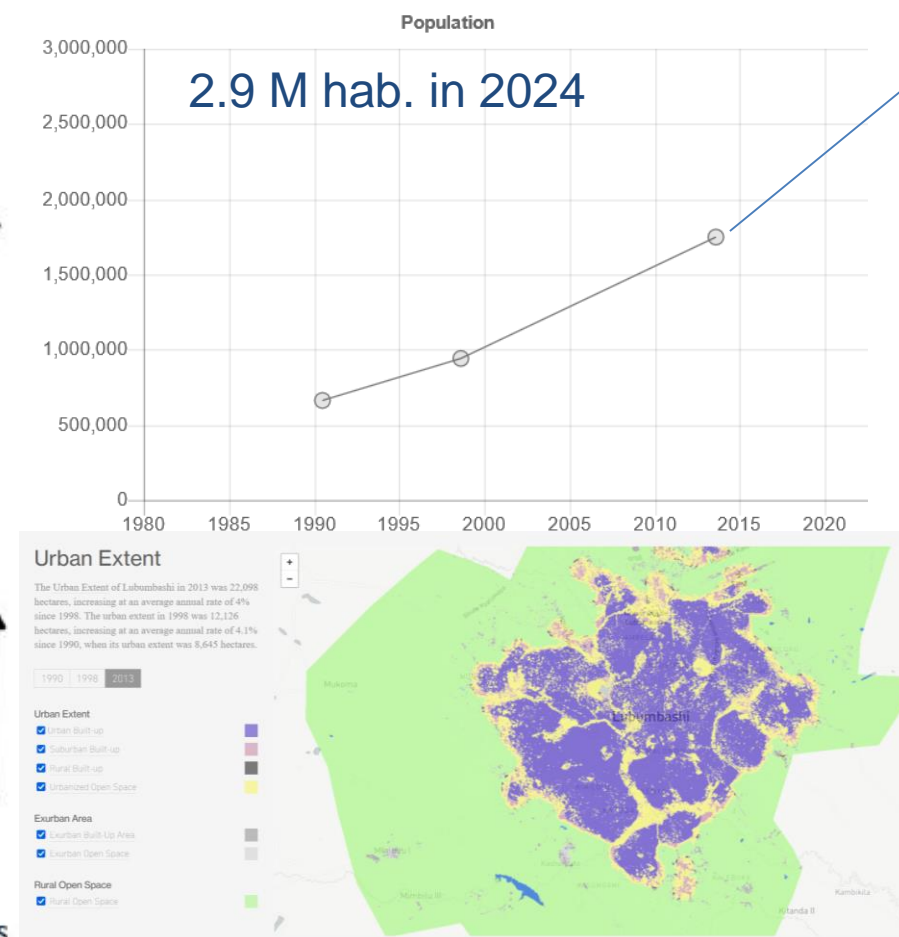
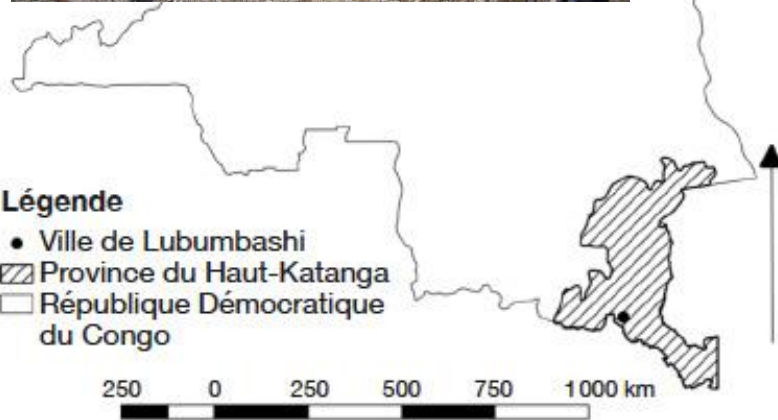
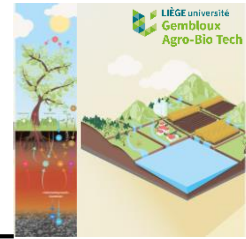
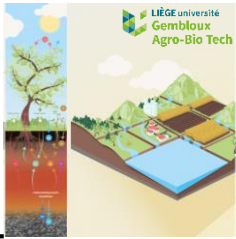


Figure 1. Localisation de la ville de Lubumbashi dans la province du Haut-Katanga, au Sud-Est de la RD Congo — *Location of Lubumbashi city in the Upper Katanga province, south-east part of the Democratic Republic of Congo.*

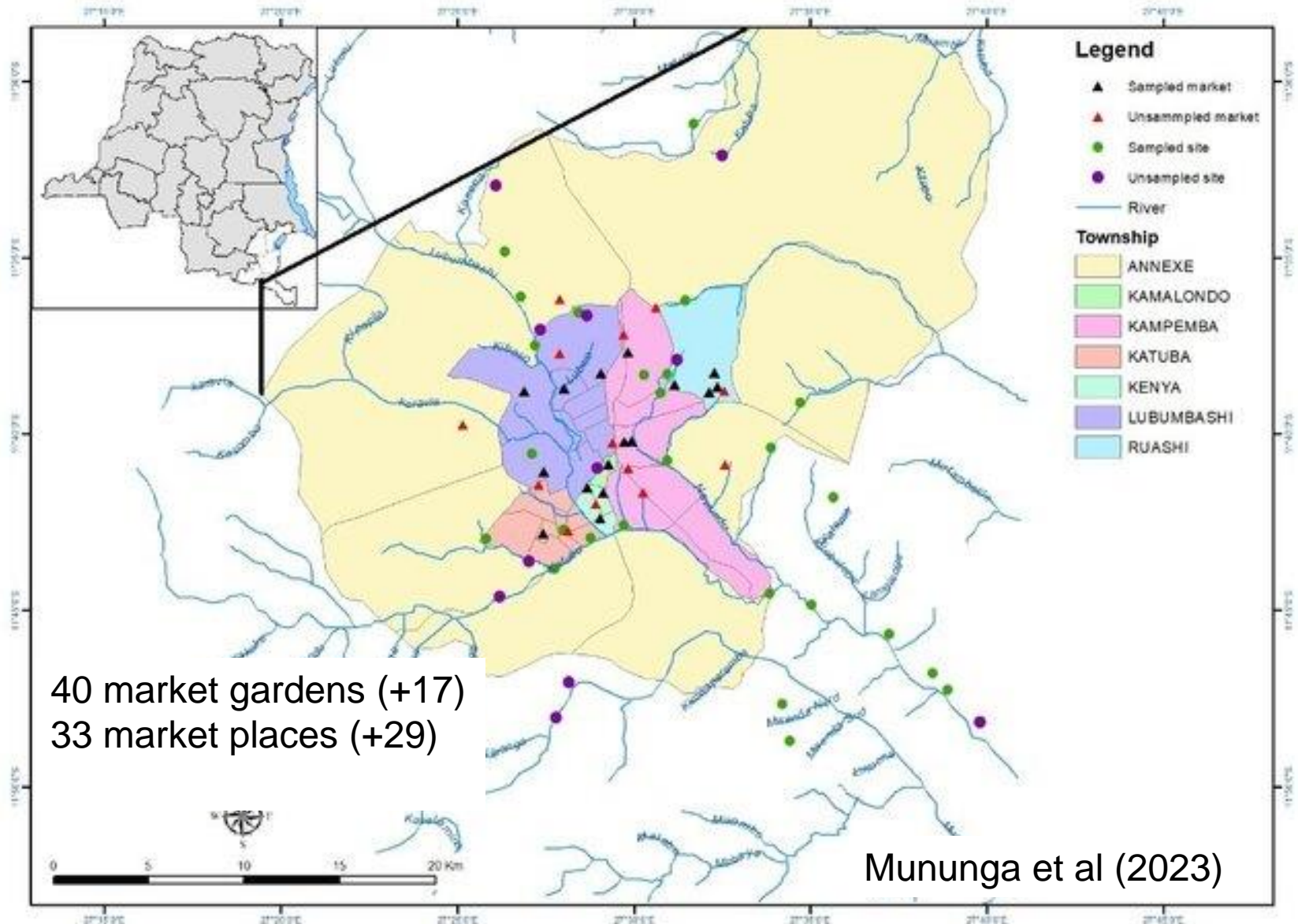
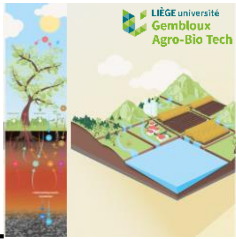
Useni et al

Lubumbashi : industrial context

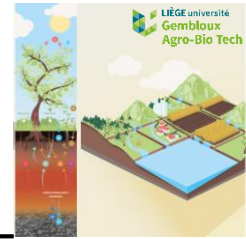


Boisson et al, 2018

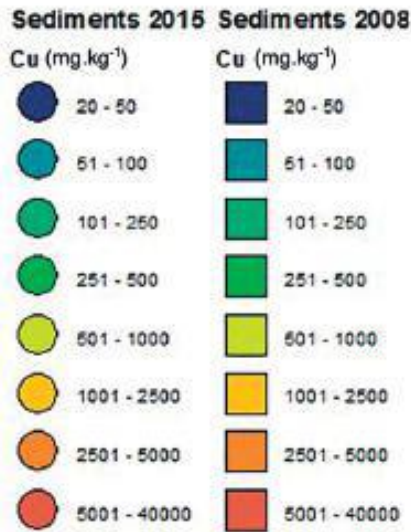
Lubumbashi: urban agriculture



Lubumbashi : soil contamination



Legend



0 0.5 1 2 3 4
Kilometers



Amaranthus hybridus & *Spinacia oleracea*

According to Mpundu et al (2013), none was satisfying regarding Cu content.

According to Muniemba et al (in press), *Amaranthus*, *Brassica chinensis*, *Brassica carinata* and *Beta vulgaris* do not fulfill WHO requirement for Co content.

Shitumba et al (2010)

Lubumbashi : ambient contaminations



Kilela et al.,
2022



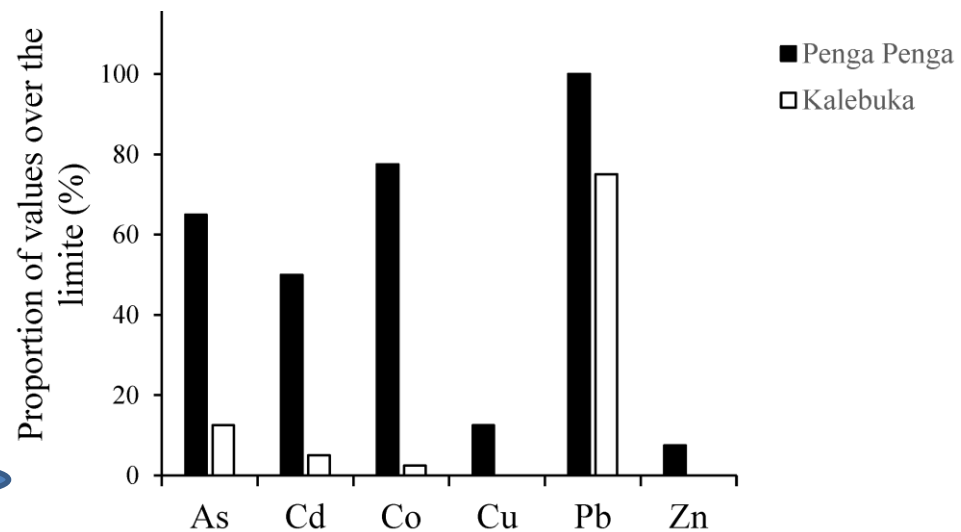
Langunu et al,
2023



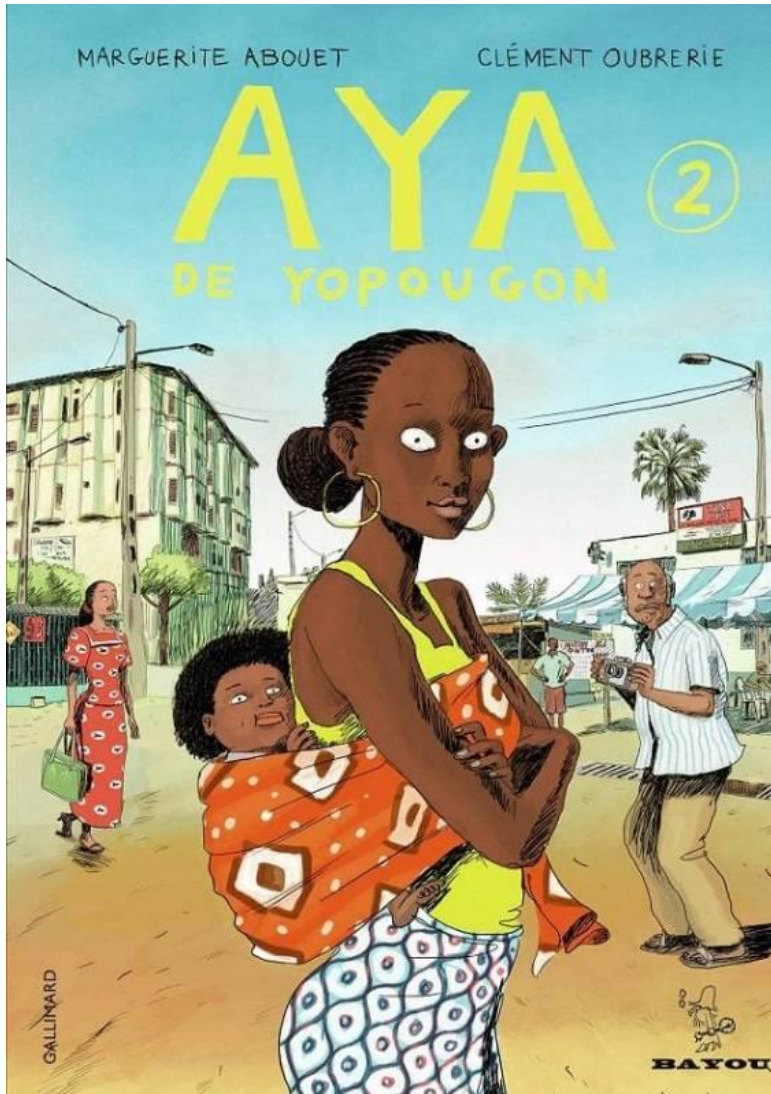
Table 3.5 : Concentration des éléments traces dans les feuilles et fruits des espèces fruitières (mg kg⁻¹). Moyenne (Minimum – Maximum) n = 8 à 12

ETM	Espèce	Penga Penga	Kalebuka	Référence*
Cu	<i>M. indica</i>	19,9 (7,9-51,9)	9,0 (5,5-12,5)	20
	<i>P. americana</i>	20,3 (12,5-51,4)	11,1 (10,8-11,4)	
	<i>P. guajava</i>	31,6 (19,2-51,1)	22,7 (22,3-23,0)	
Feuille Co	<i>M. indica</i>	1,6 (0,6-2,4)	1,1 (0,8-1,5)	1
	<i>P. americana</i>	2,3 (1,4-3,8)	1,9 (1,5-2,2)	
	<i>P. guajava</i>	2,6 (1,3-5,3)	2,1 (1,9-2,4)	
Zn	<i>M. indica</i>	40,1 (21,1-93,4)	24,1 (20,3-27,8)	100
	<i>P. americana</i>	56,0 (24,7-114,8)	32,2 (16,9-47,4)	
	<i>P. guajava</i>	59,6 (34,8-86,4)	36,6 (31,3-41,8)	
Cu	<i>M. indica</i>	5,8 (4,5-7,1)	4,0 (3,2-4,7)	20
	<i>P. americana</i>	11,4 (6,6-18,5)	6,8 (6,6-7,0)	
	<i>P. guajava</i>	10,8 (7,8-14,5)	10,6 (9,1-12,1)	
Fruit Co	<i>M. indica</i>	0,5 (0,4-0,6)	0,2 (0,2-0,3)	1
	<i>P. americana</i>	1,3 (1,0-1,5)	0,5 (0,4-0,5)	
	<i>P. guajava</i>	2,0 (0,5-4,9)	0,5 (0,5-0,6)	
Zn	<i>M. indica</i>	14,7 (10,9-18,5)	12,9 (7,2-18,5)	100
	<i>P. americana</i>	37,3 (12,8-93,0)	22,5 (17,8-27,2)	
	<i>P. guajava</i>	29,4 (18,9-50,6)	16,7 (15,7-17,6)	

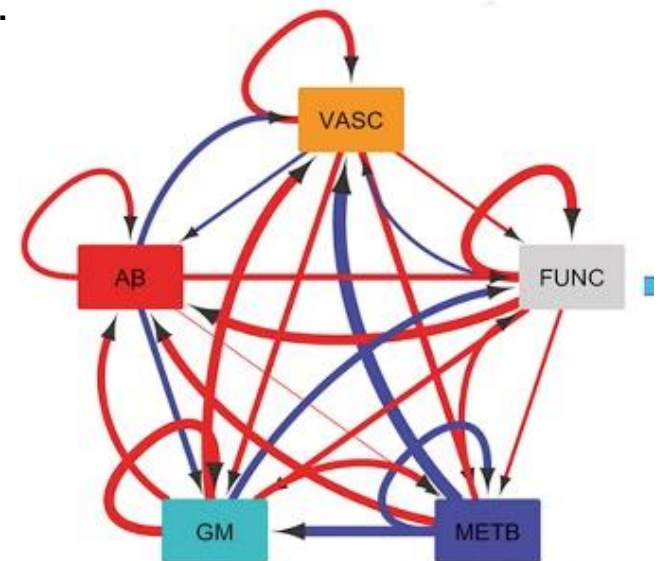
*(Elderfield, 2000 ; Mendez et Maier, 2008)



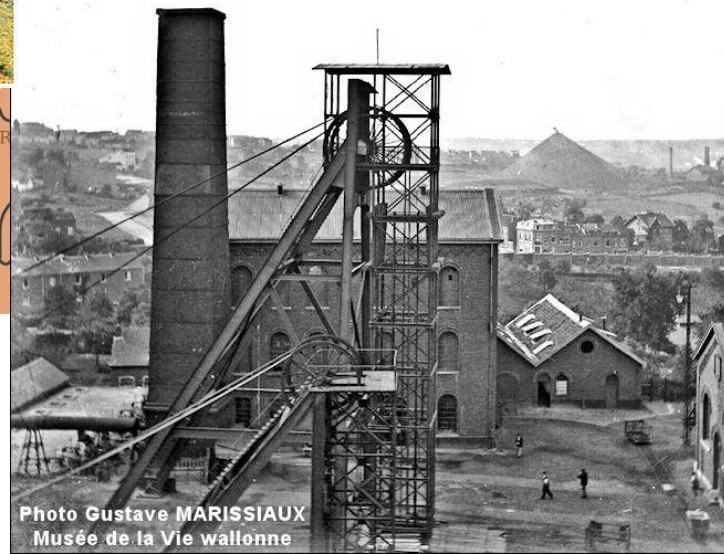
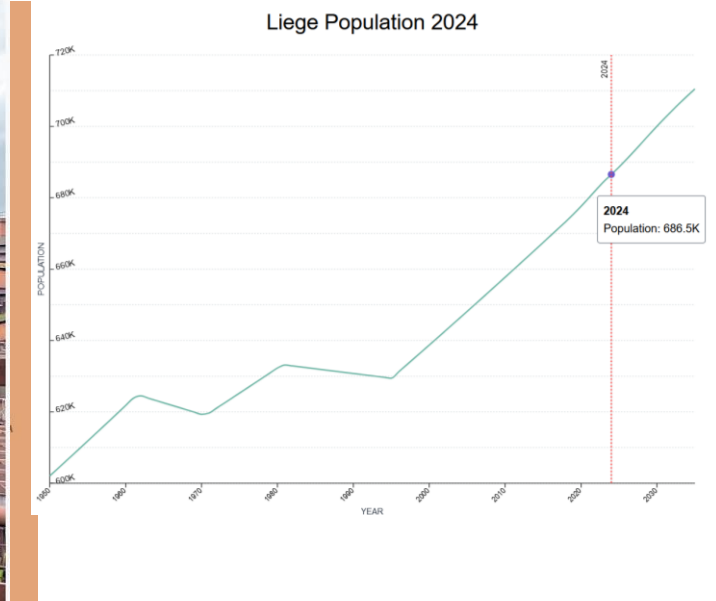
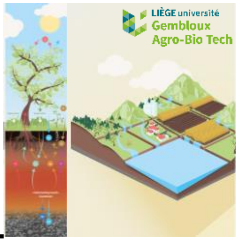
Lubumbashi : people



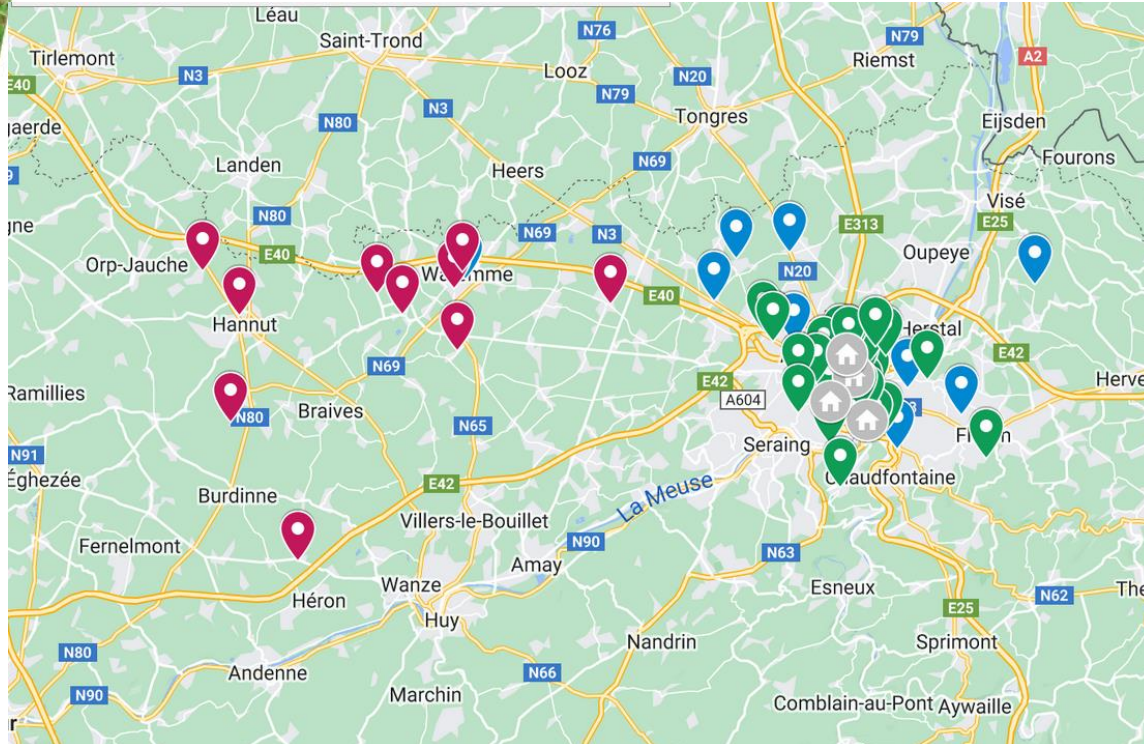
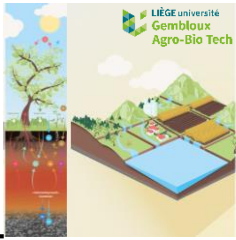
- Blood and urine contaminations for people in contaminated districts of Lubumbashi (Banza et al., 2009)
- Malformations
- Mn and Zn effect on birth defects ? (Van brusselen et al, 2020)
- Erectile diseases
- ...



Liège : from industrial past...



Liège : ...to rise of food transition



NOURRIR LIÈGE 2024

FESTIVAL DE TRANSITION ALIMENTAIRE EN CITÉ ARDENTE • DU 11 AU 21 AVRIL 2024

MARCHÉS • BALADES • REPAS • SPECTACLES • MASTERCLASS • ATELIERS • DÉBATS • WWW.NOURRIRLIEGE.BE

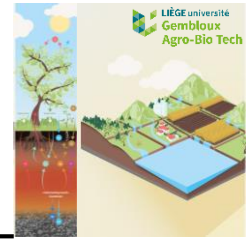
The poster features colorful illustrations of people engaged in various activities: a person with a flag, a person with a basket, a person with a bicycle, and a person with a wheelbarrow. There are also illustrations of a chicken and bees.

Liège : strong demand for ES

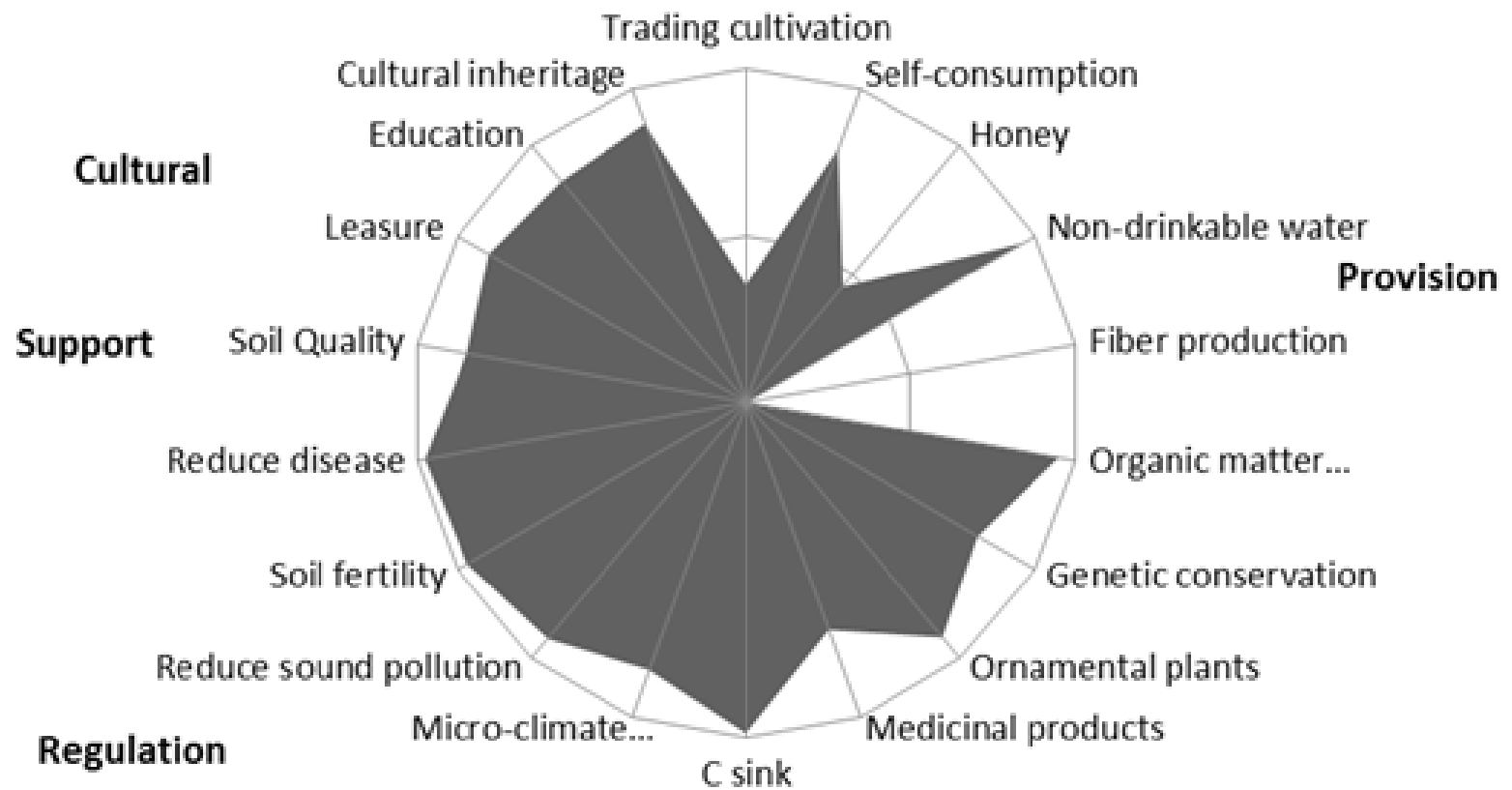


Schram-Bijkerek et al (2018)

Liège : strong demand for ES

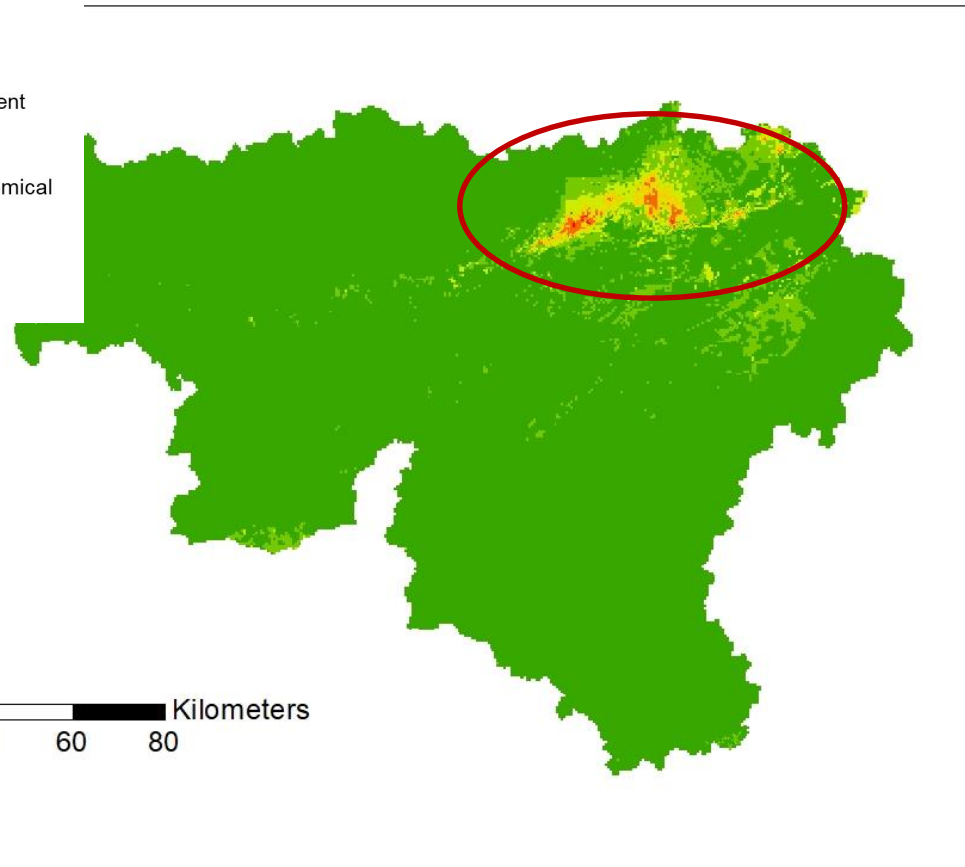
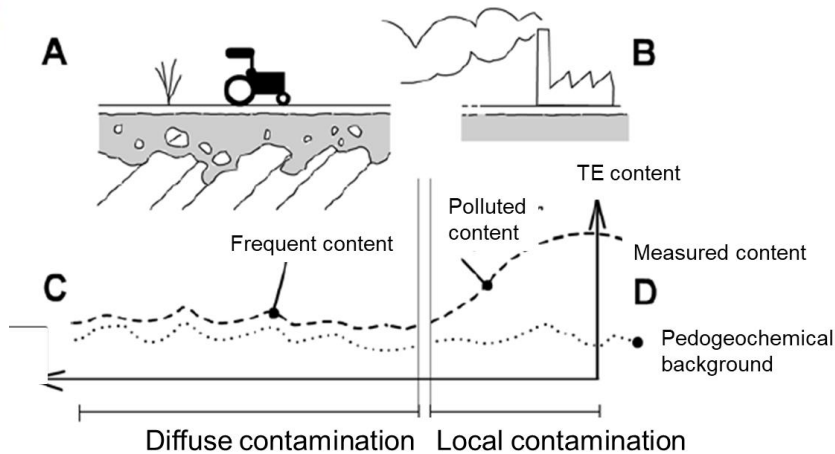
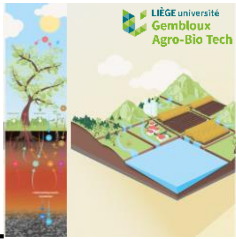


Ecosystemic services from collective gardens



Urban Soil project

Liège : soil contaminations



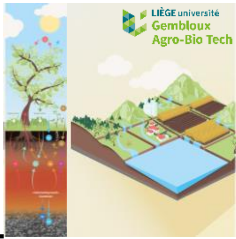
Legend

Cd Median
mg/kg

0,30 - 1,11
1,11 - 2,20
2,20 - 3,40
3,40 - 5,74
5,74 - 12,64
12,64 - 21,37

Assessment of frequent content of soil Cd : median Cd in mg/kg

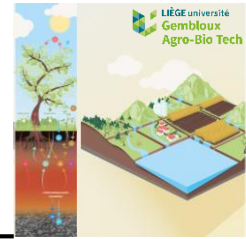
Liège : food contamination - gardens



No direct threshold of content in EU or state regulations for self-production.

Risk analysis based on scenarios : source, pathway, target

Liège : food contamination – market gardens



20.12.2006

EN

Official Journal of the European Union

L 364/5

COMMISSION REGULATION (EC) No 1881/2006
of 19 December 2006
setting maximum levels for certain contaminants in foodstuffs
(Text with EEA relevance)

(39) As regards **lead**, the SCF adopted an opinion on 19 June 1992 ⁽²²⁾ endorsing the provisional tolerable weekly intake (PTWI) of **25 µg/kg bw** proposed by the WHO in 1986. The SCF concluded in its opinion that the mean level in foodstuffs does not seem to be a cause of immediate concern.

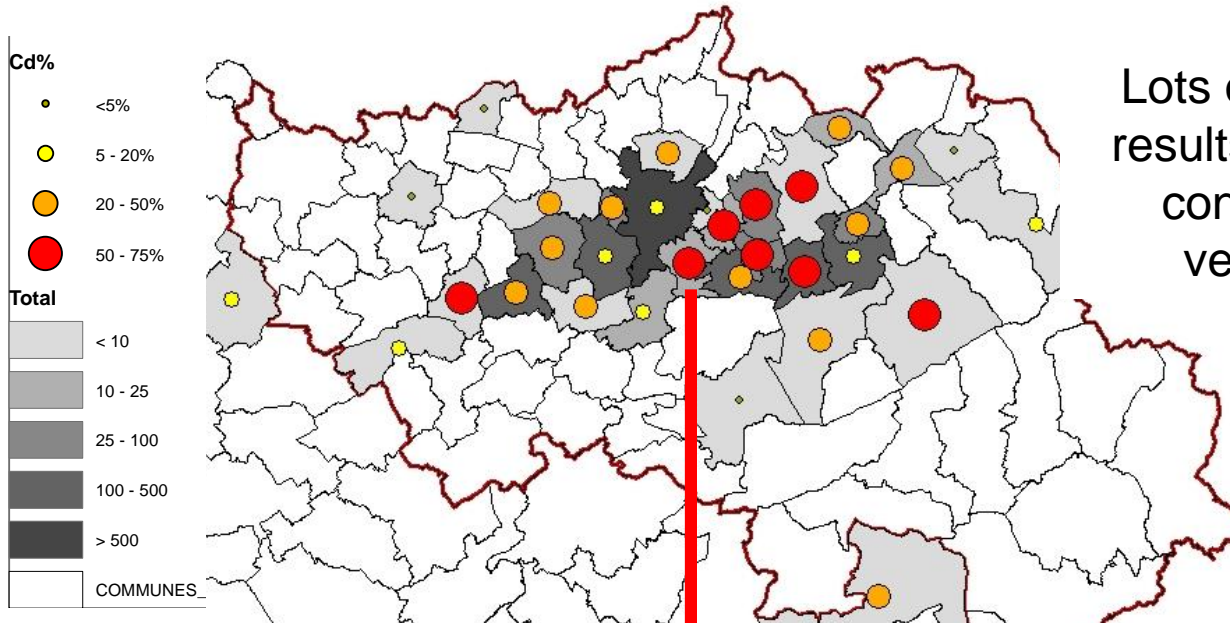
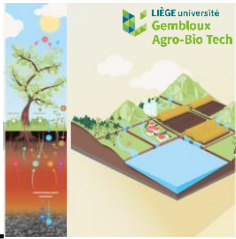
⁽²²⁾ Reports of the Scientific Committee for Food, 32nd series, Opinion of the Scientific Committee for Food on 'The potential risk to health presented by lead in food and drink', p. 7, http://ec.europa.eu/food/fs/sc/scf/reports/scf_reports_32.pdf

(41) As regards **cadmium**, the SCF endorsed in its opinion of 2 June 1995 ⁽²⁴⁾ the PTWI of **7 µg/kg bw** and recommended greater efforts to reduce dietary exposure to cadmium since foodstuffs are the main source of human intake of cadmium. A dietary exposure assessment was performed in the SCOOP-task 3.2.11. In view of this assessment and the opinion delivered by the SCF, it is appropriate to take measures to reduce the presence of cadmium in food as much as possible.

⁽²⁴⁾ Reports of the Scientific Committee for Food, 36th series, Opinion of the Scientific Committee for Food on cadmium, p. 67, http://ec.europa.eu/food/fs/sc/scf/reports/scf_reports_36.pdf

EU regulation changed recently : globally more severe and introduction of numerous classes of vegetables

Liège : food contamination - gardens

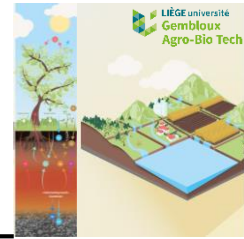


Lots of analytical results show non-conformity of vegetables



Biomonitoring of population revealed high impregnation in As, Cd and Pb

Liège : food contamination – market gardens



ACCUEIL VIDÉO AUDIO MON CHOIX CHÂÎNES THÉMATIQUES PLU

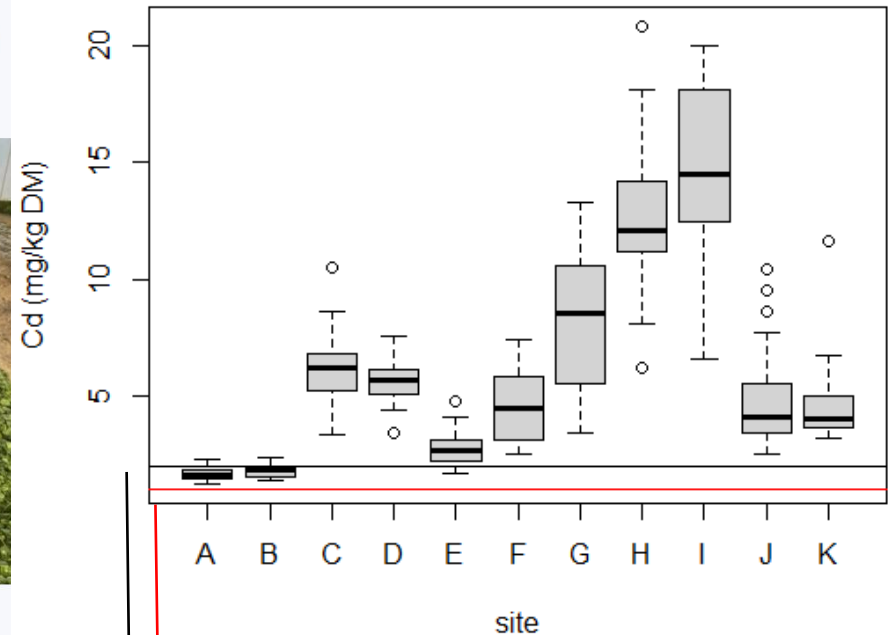
REGIONS LIEGE

Les normes en métaux lourds menacent les maraichers en région liégeoise



13 janv. 2022 à 16:11 · 2 min
Par Marc Mélon avec C. Adam

Organic farming
~ 100 farms



Old vs **New** threshold

What solutions ?

Eliminate the pathways



Hydroponic tests in Lubumbashi
PhD thesis Mununga (ARES project)



Crop cultivation in containers in Trooz

What solutions ?

Relationship between Cd in salad & soil pH

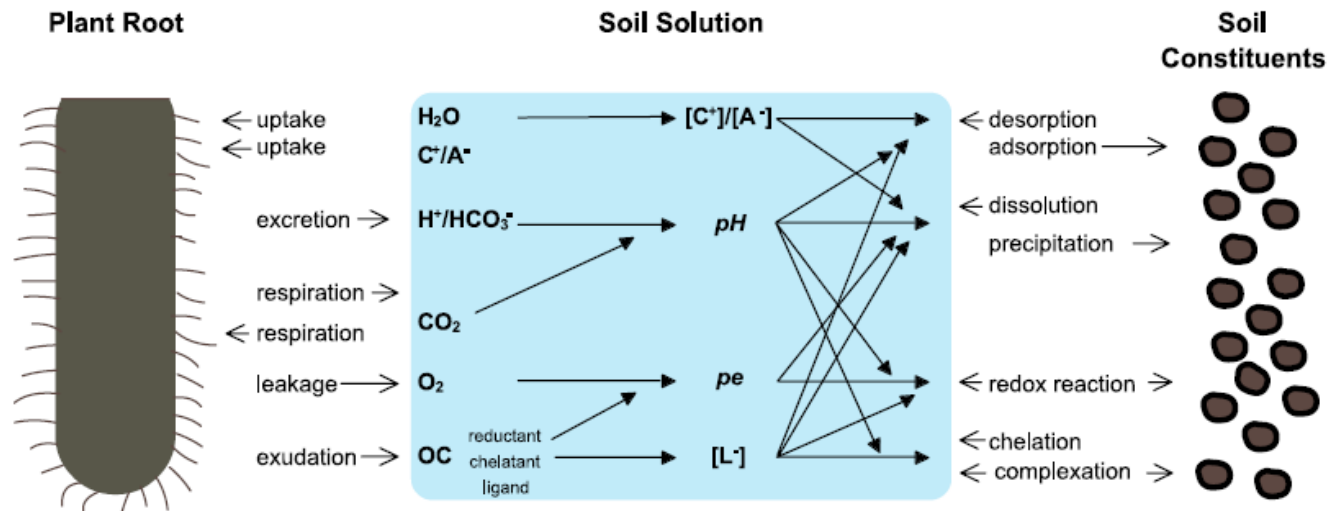
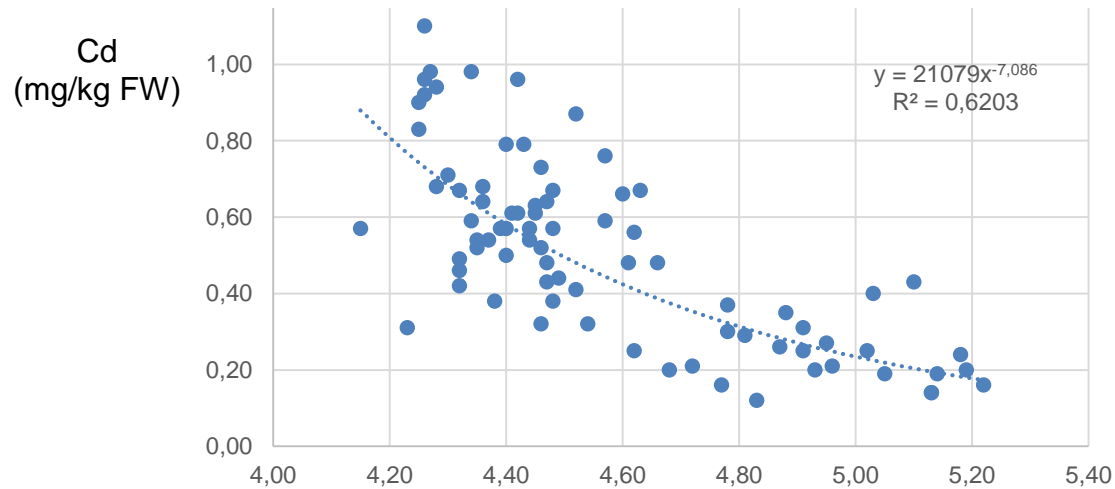
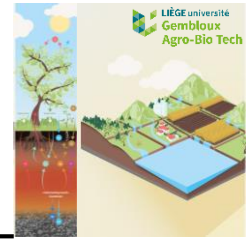
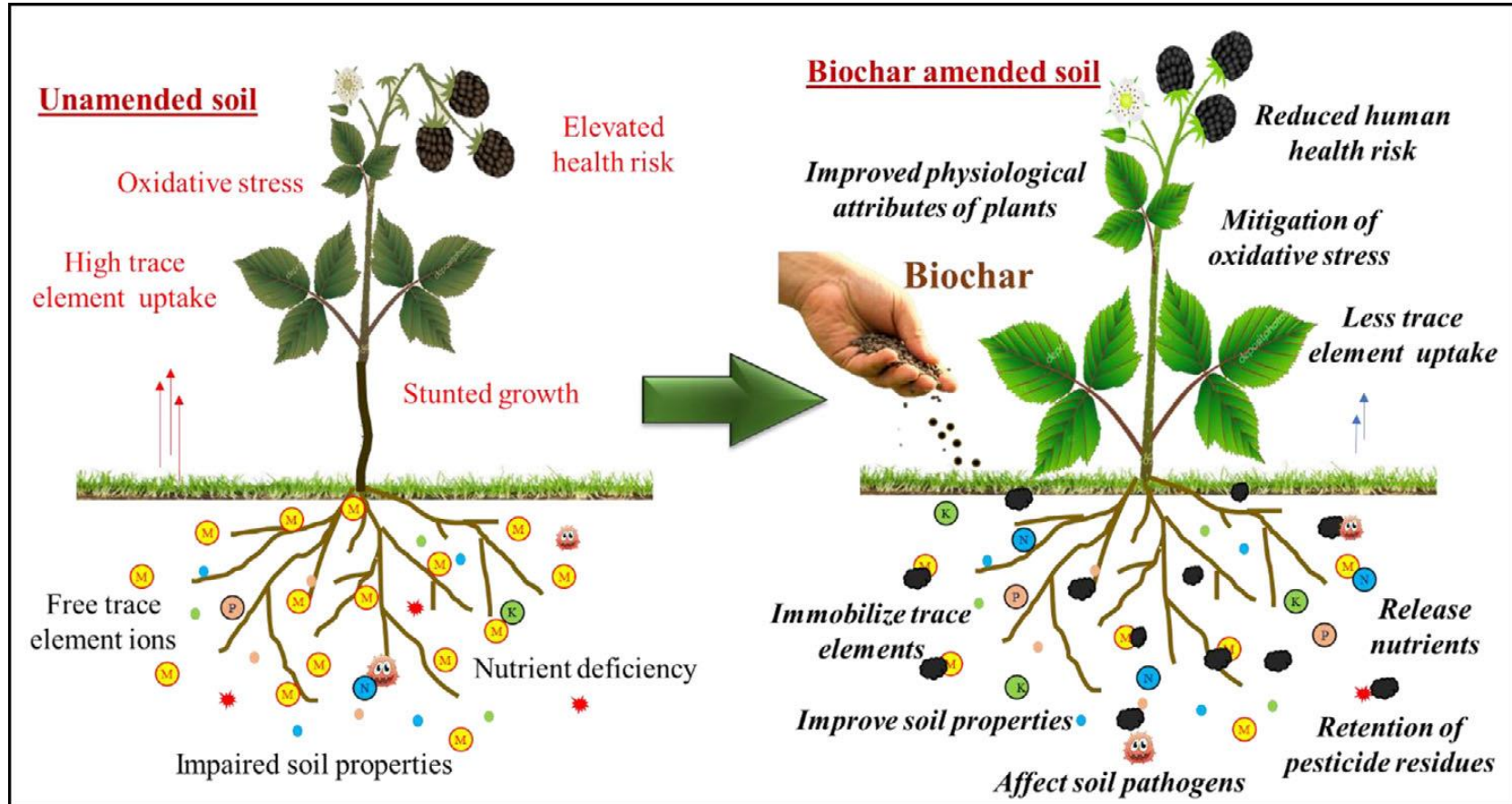


Fig. 2. Schematic of the rhizosphere, showing the various exudates and how they can influence abiotic factors and mechanisms in the soil-solution interface. Legends: OC = organic carbon; C^+ = cation; A^- = anion; L^- = ligand; pe = redox potential. Modified from Hinsinger (2001).

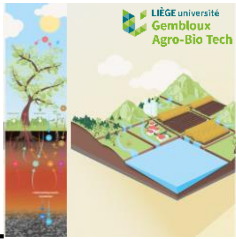
What solutions ?



Amending soil to modify bioavailability of contaminants



What solutions ?



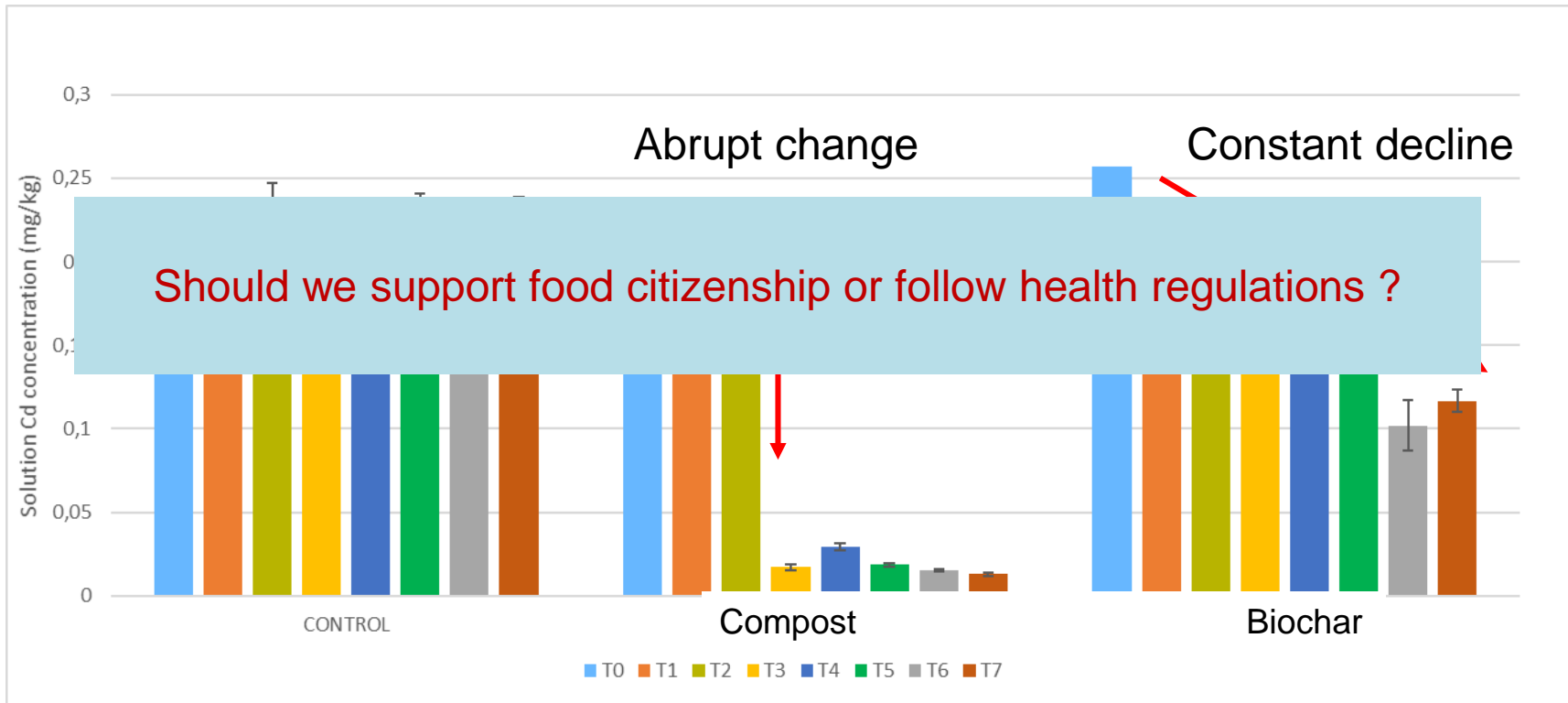
Lots of pot and field experiments were conducted in both study cases : lime and OM mainly



Results so far show that sanitary thresholds are difficult to satisfy and pose real questions about their relevance.

To conclude

It seems important to be communicate clearly and honestly –
exageration about supposed benefits of treatments / technologies.



Time and additional data are needed prior to make decisions.