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Assessing potential soil ecosystemic services in urban green areas from measurements of soil properties : insight from the URBSERSOl project

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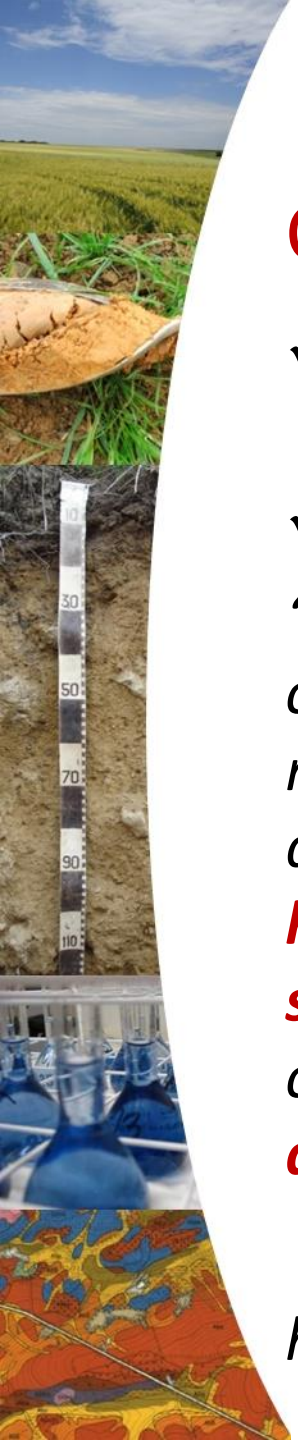
GLASGOW22
22ND WORLD CONGRESS OF
SOIL SCIENCE

Wallonie
service public
SPW



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Context

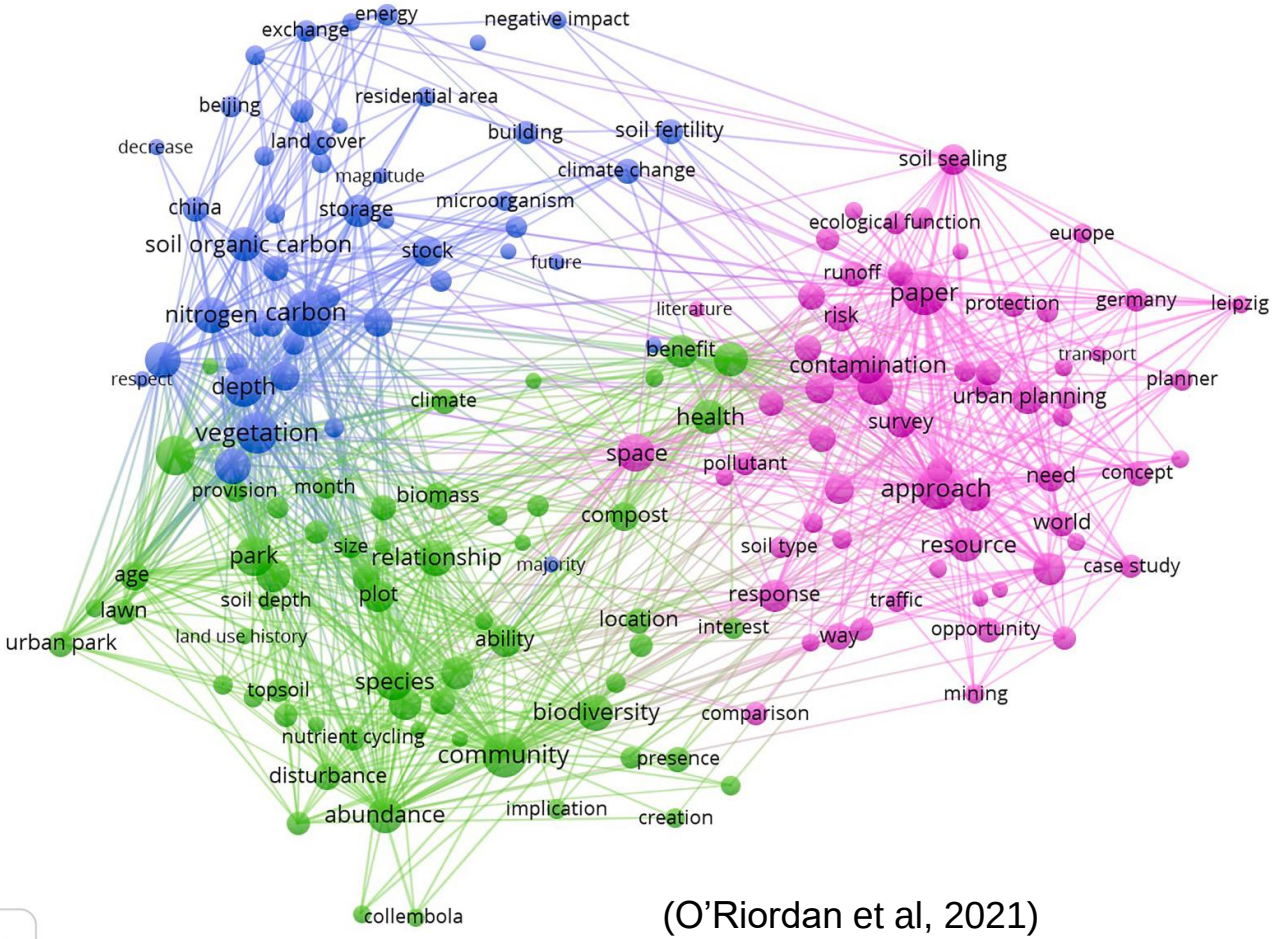
- ✓ 66 % of population living in urban areas in 2050 at global scale
- ✓ Cities of the future must answer to multiple challenges :

*"The close linkage between **space/service/people** is at the core of cities' capacities to respond to people's needs and to manage new challenges in a wider context, beyond administrative boundaries and sectorial domains. A truly **holistic** approach is needed to optimise the **provision of services** and create an intelligent interaction between the city and its inhabitants while maintaining or enhancing **quality of life**. "*

https://urban.jrc.ec.europa.eu/thefutureofcities/

Context

✓ Urban soils can fulfill a lot of ecosystemic services

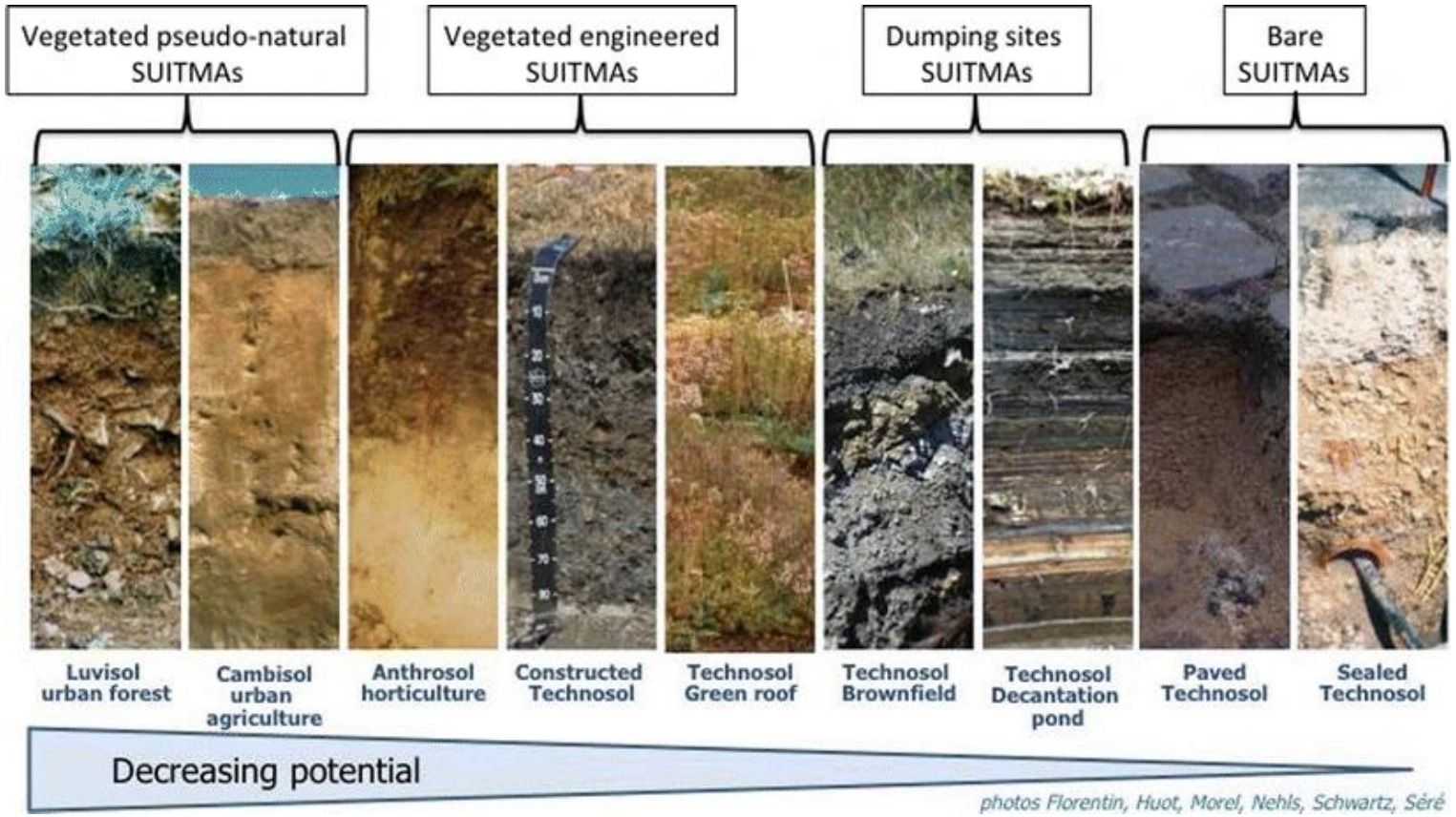


(O'Riordan et al, 2021)

VOSviewer

Context

✓ Lack of knowledge about urban soils



(Morel et al, 2014)

Context

✓ Weak quantification of links from soil characteristics to ES

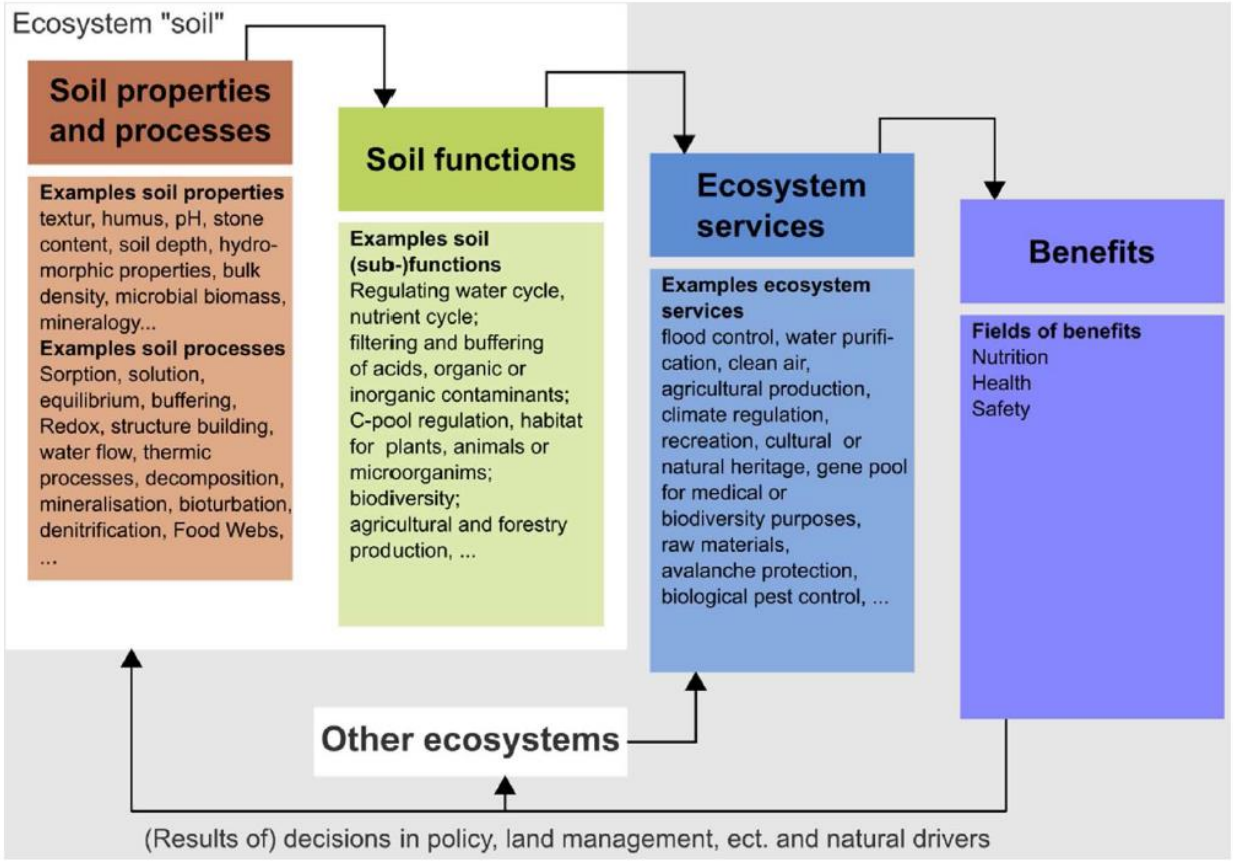
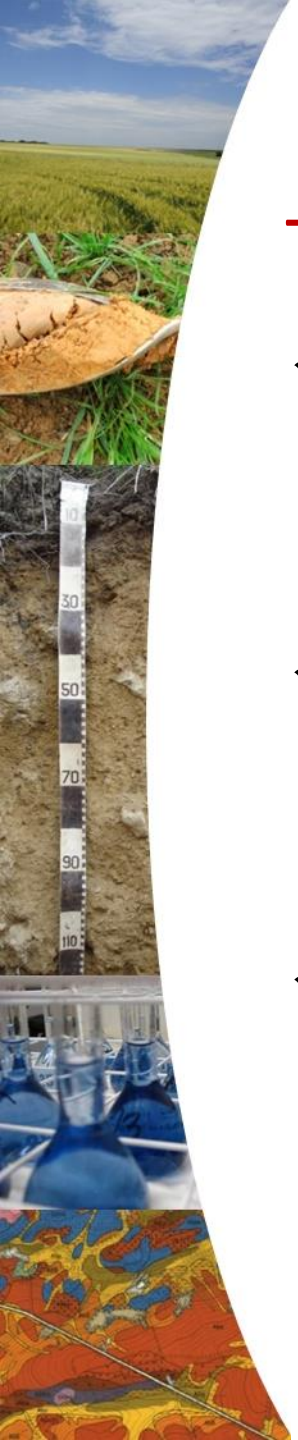


Fig. 1. Assessment of the contributions of soil functions to ecosystem services using the cascading framework developed by Haines-Young and Potschin (2008).

(Greiner et al, 2017)

The URBSERSOL project

- ✓ Goals : Develop tools for stakeholders in order to take into account actual, expected and potential ecosystemic services of urban areas
  - ❖ Better knowledge of urban soils types and characteristics ;
  - ❖ Evaluate the expected services on 3 study cases through participatory approach
  - ❖ Identify key indicators and data assimilation procedure to quantify the actual and potential ecosystemic services



The 3 study cases

- ✓ Development of local food production near big cities :
  - ❖ Can safe vegetables be grown on soils ?
  - ❖ What are the other ES given by market gardens ?

- ✓ Numerous brownfields and urban wastelands:
  - ❖ What are the actual ES of wastelands ?
  - ❖ How could we better valorize them ?

- ✓ Regulation on use of pesticides modifies the practices of weed management in public parks :
  - ❖ What are the ES given by green areas in cities ?
  - ❖ Can the changes of practices modify soil functions and ES ?

Soil survey

Figure

1.3 Description détaillée

Ah : 0 – 40cm. Limon brun foncé à noir (10YR 2/1). Structure grumeleuse dans les vingt premiers cms, grenue et polyédrique sub-angulaire peu nette. Très peu compact et très friable. Très poreux. Forte activité biologique. Quelques racines, fines à très fines.

A/C : 40 – 60 cm. Limon brun foncé (10YR 3-2). Structure polyédrique à grenue. Peu compact et très friable, poreux. Peu de racines, galeries de vers et charbon de bois visibles. Revêtements dans les galeries

C : 60 – 85 cm. Limon brun (10YR 4/2-6) remanié. Horizon de transition. Peut-être mélange entre 2C et Remblais ? Compact à très compact. Peu friable. Poreux. Galeries de vers de terre avec revêtements organo-argileux.

2C : > 85 cm. Limon brun (10YR 5/6) enfoui. Structure massive. Très compact et peu friable. Poreux. Peu de racines. Activité biologique importante (galeries de vers de terre). Revêtements dans les galeries.

	ID_HOR	ID_Profil	Symbole	Prof_up	Prof_down	Tranche	Hum	Texture	COL_H	COL_V	COL_C	Spot_nr	Spot_size	Spot_source	Spot_H	Spot_V	Spot_C	STR_1	STR_1_size	STR_
2						- cm						0								
3	L22_01	L22	Ap	0	10	0 - 10 cm	Frais à sec		10YR	2	1	0						Grumeleuse		Polyé
4	L22_02	L22	Ap	10	20	10 - 20 cm	Frais à sec		10YR	2	1	0						Grumeleuse		Polyé
5	L22_03	L22	Ap	20	30	20 - 30 cm	Frais à sec		10YR	2	1	0						Grenue		Polyé
6	L22_04	L22	Ap	30	40	30 - 40 cm	Frais à sec		10YR	2	1	0						Grenue		Polyé
7	L22_05	L22	A/C	40	50	40 - 50 cm	Frais à sec		10YR	3	2	0						Grenue		Polyé
8	L22_06	L22	A/C	50	60	50 - 60 cm	Frais à sec		10YR	3	2	0						Grenue		Polyé
9	L22_07	L22	C	60	70	60 - 70 cm	Frais à sec		10YR	4	2	0						Massive		
10	L22_08	L22	C	70	80	70 - 80 cm	Frais à sec		10YR	4	2	0						Massive		
11	L22_09	L22	C/2C	80	90	80 - 90 cm	Frais à sec		10YR	4	6	0						Massive		
12	L22_10	L22	2C	90	100	90 - 100 cm	Frais à sec		10YR	5	6	0						Massive		
13	L27_01	L27	Ap	0	10	0 - 10 cm	Frais à sec		10YR	3	1	0						Grumeleuse		Poly
14	L27_02	L27	Ap	10	20	10 - 20 cm	Frais à sec		10YR	3	1	0						Grumeleuse		Polyé
15	L27_03	L27	Ap	20	30	20 - 30 cm	Frais à sec		10YR	3	1	0						Grenue		Polyé
16	L27_04	L27	Ap	30	40	30 - 40 cm	Frais à sec		10YR	3	1	0						Grenue		Polyé
17	L27_05	L27	Ah	40	50	40 - 50 cm	Frais à sec		10YR	3	1	0						Grenue		Polyé
18	L27_06	L27	Ah	50	60	50 - 60 cm	Frais à sec		10YR	3	1	0						Grenue		Polyé
19	L27_07	L27	A/C	60	70	60 - 70 cm	Frais à sec		10YR	4	2	0						Polyédrique sub-angulaire		Polyé

Soil survey

« Natural soil »

Landfill and waste material over existing soil

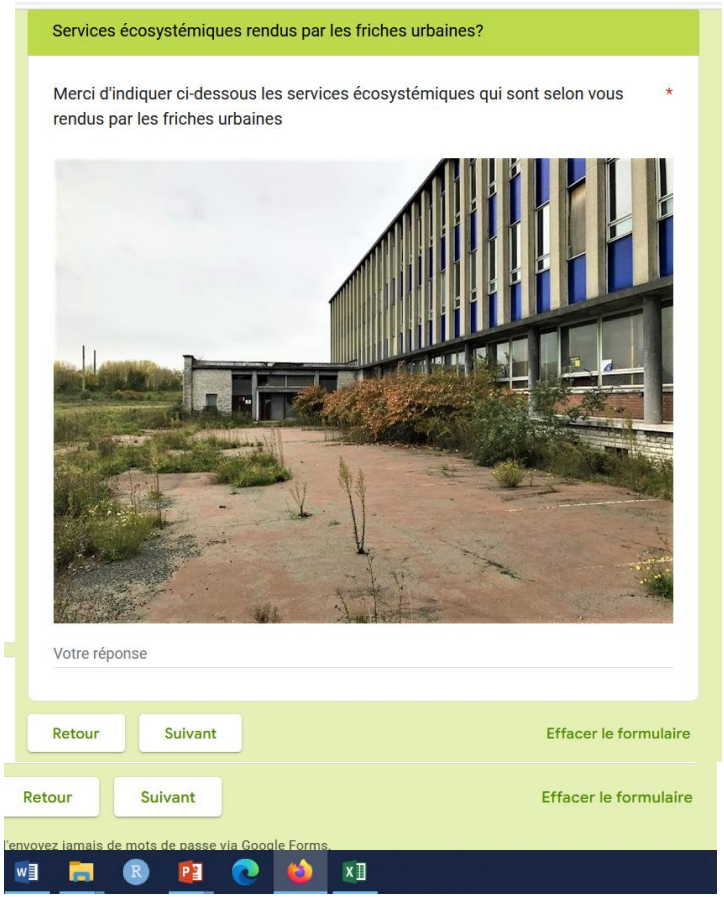
Allochtonous materials

~ 100 profiles sampled and described, another 50 to finish…

Participatory approach

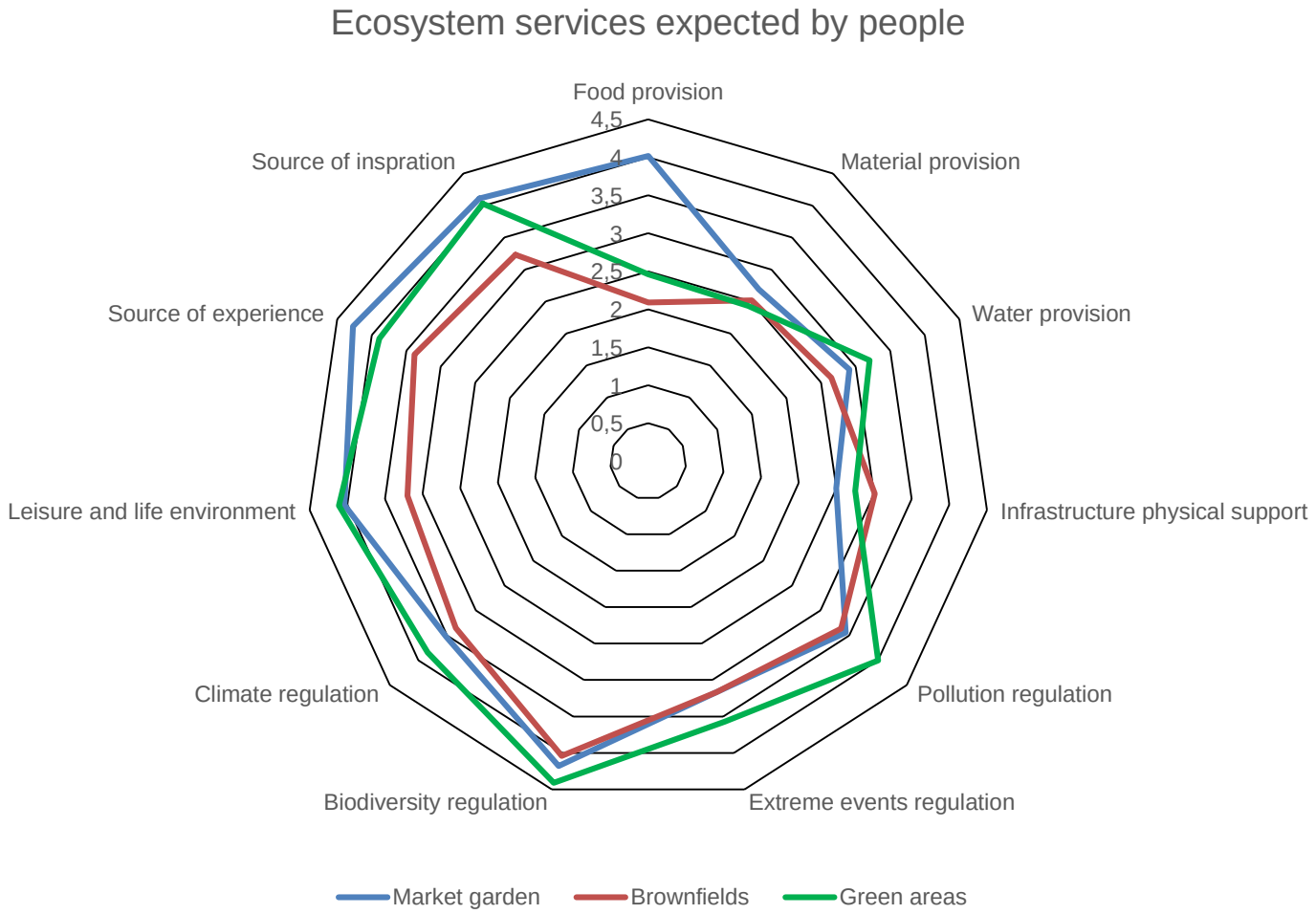




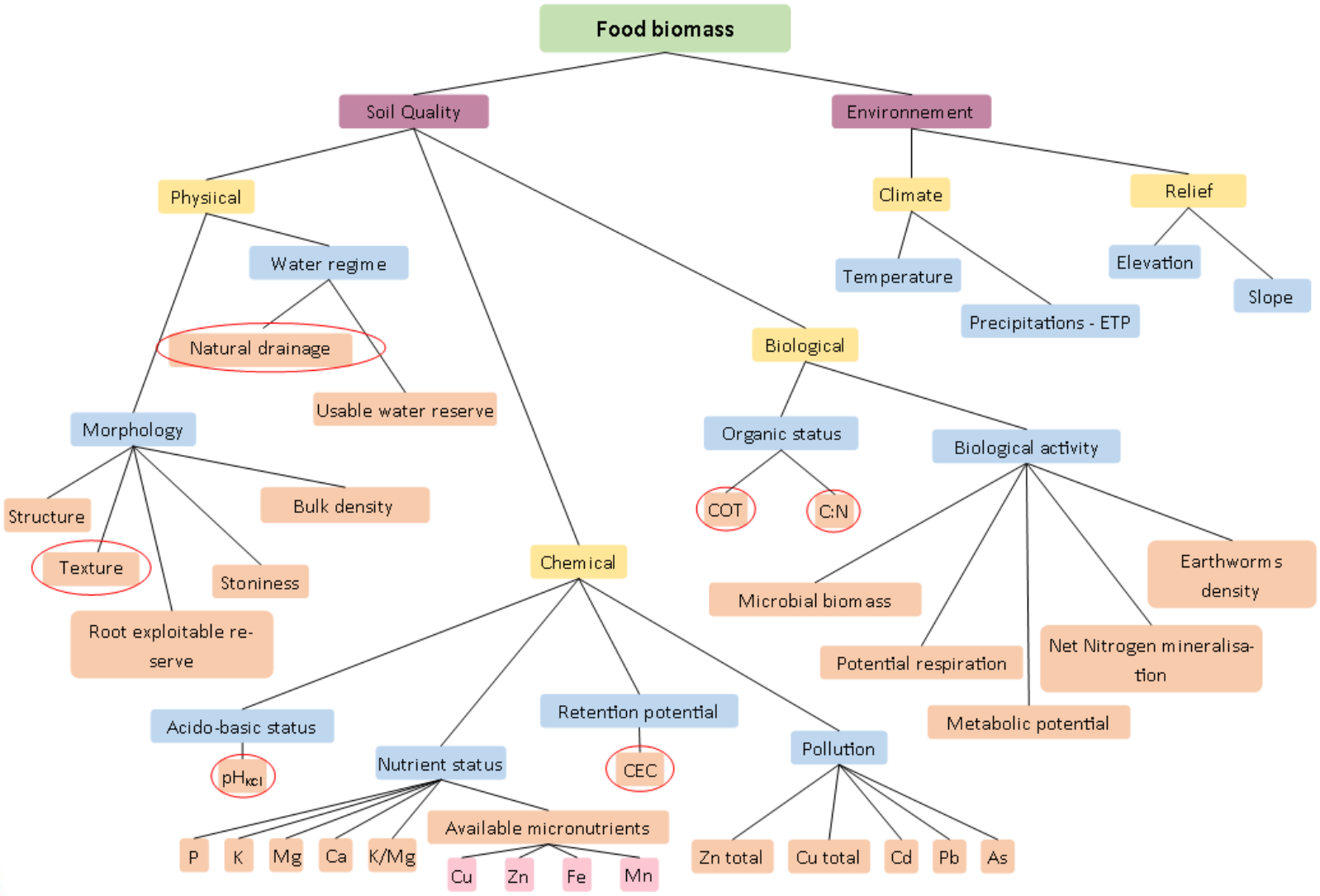



Focus group (qualitative) + Google form (quantitative ~ 350)

Participatory approach

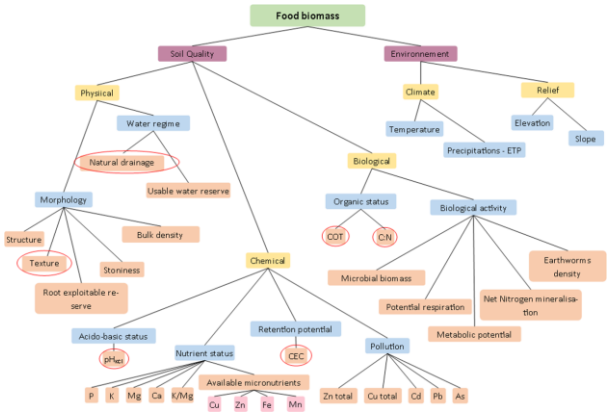


From soil characteristics to ES

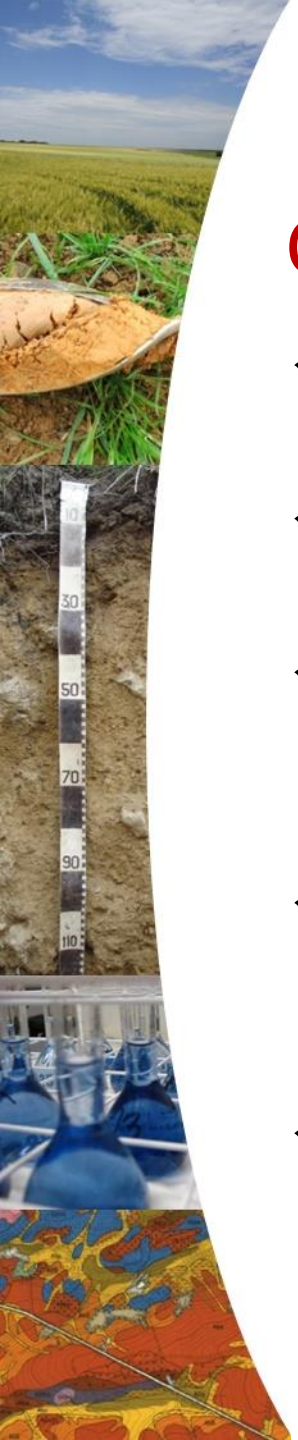


From soil characteristics to ES

Indicateurs	Unités		Scores 1	2	3	4	5	Références	MDS
Structure	/		VS 0	/	VS 1	/	VS 2	FAO, 2008	Non
Pierrosité	%		≥ 80	≥ 40 < 80	≥ 15 < 40	≥ 5 < 15	< 5	FAO, 2006	Non
Texture	Classe texturale		/	/	U	Z S G	L A E P	Aksoy et al., 2017	Oui
Masse volumique apparente (fonction de la classe texturale)	g. cm^{-3}	Z	> 1,80	≤ 1,80 > 1,69	≤ 1,69 > 1,65	≤ 1,65 > 1,60	≤ 1,60	USDA-NRCS, 2021	Non
		S P	> 1,80	≤ 1,80 > 1,63	≤ 1,63 > 1,51	≤ 1,51 > 1,40	≤ 1,40		
		A L E	> 1,70	≤ 1,70 > 1,60	≤ 1,60 > 1,50	≤ 1,50 > 1,40	≤ 1,40		
		U	> 1,53	≤ 1,53 > 1,44	≤ 1,44 > 1,27	≤ 1,27 > 1,10	≤ 1,10		
		G	/	/	> 0	/	/		
Profondeur du sol exploitable par les racines	cm		< 20	≥ 20 < 40	≥ 40 < 80	≥ 80 < 125	≥ 125	Légende de la CNSW	Non



What assimilation procedure ?
Mean, Minimum…
Different weights
Limitations : capability maps



Conclusion

- ✓ There is a need for a better knowledge of urban soils and their functions in order to evaluate their ES.
- ✓ Numerous studies have reported about the strong variability of urban soil properties due to anthropisation.
- ✓ Our soil survey indicates that landfilling is the most common perturbation but it does not imply de facto a soil degradation.
- ✓ The participatory exercise on three study cases gave insights about land users perception and expectation about the ES that the areas (soil+usage) can supply.
- ✓ In order to take into account the soil potential to fulfill other ES than actual (land use change), a methodology to aggregate multiple indicators into a single one is needed.