



Session 6 Biodiversity
in urban soils: threats
and opportunities

Biodiversity reserve as an ecosystem service provided by urban soils

Apolline Auclerc & Quentin Vincent



Context

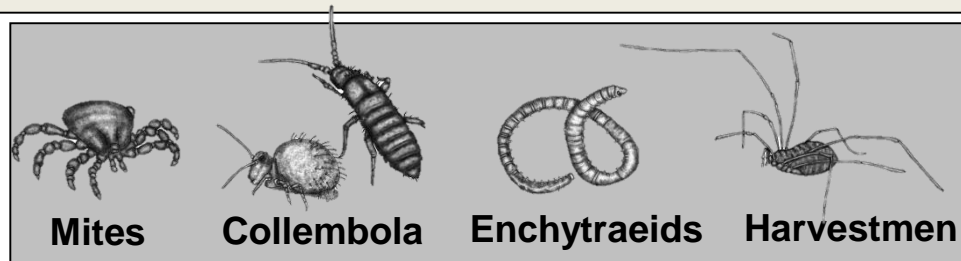
What are soil invertebrates?

**HIGH
TAXONOMICAL
BIODIVERSITY**

Macro-invertebrates > 2mm



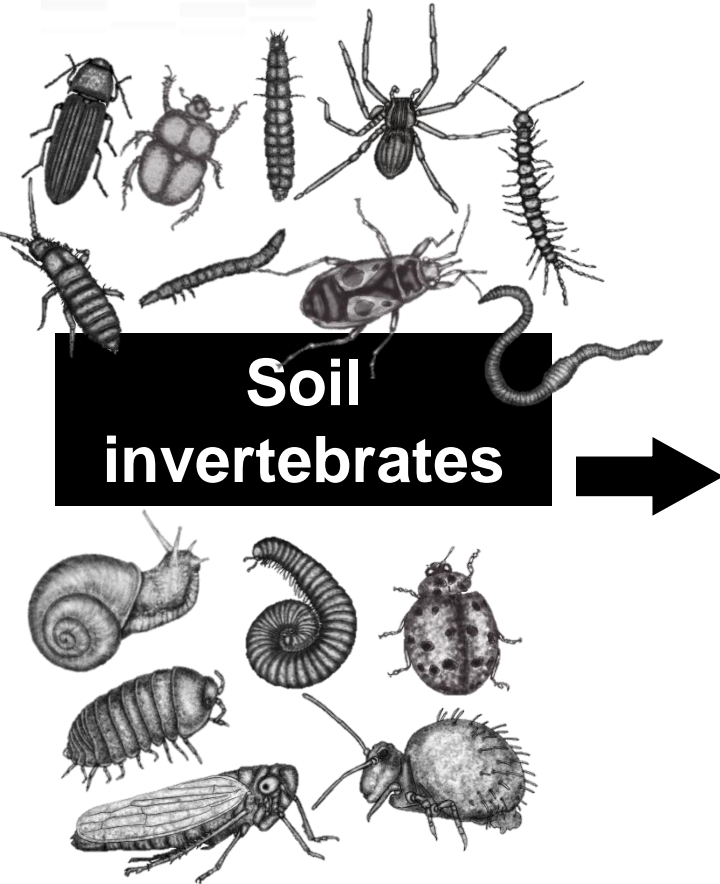
Meso- invertebrates 0.2 << 2mm



Context

Which roles played by soil invertebrates?

**HIGH
FUNCTIONAL
BIODIVERSITY**



**Soil
invertebrates**

**Functional
processes**

Regulation

Degradation &
Mineralization

Soil structuration

Coleman *et al.*, 2004

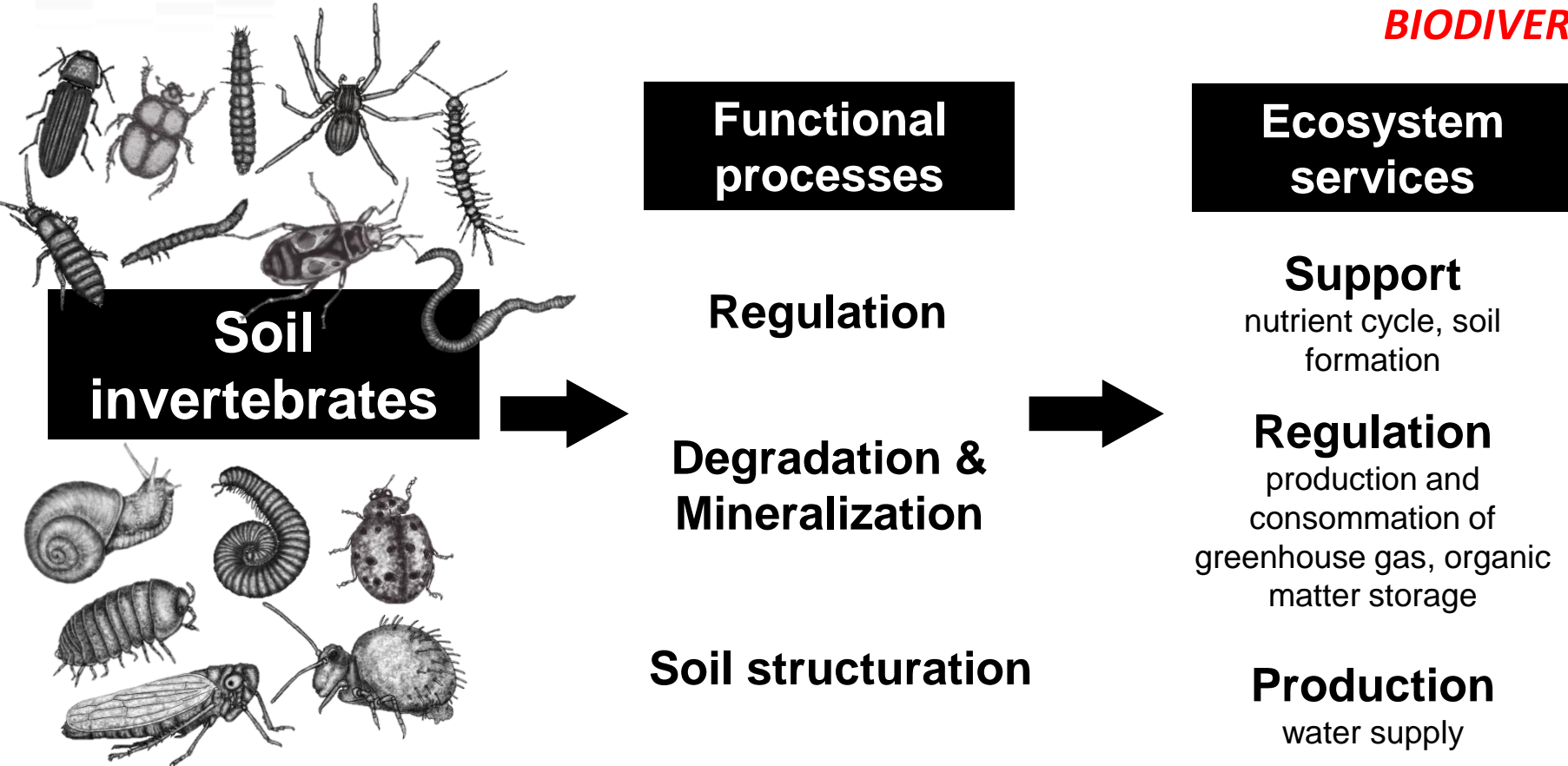
Lavelle *et al.*, 2006

Blouin *et al.*, 2013

Context

Which services supplied by soil invertebrates?

**HIGH
FUNCTIONAL
BIODIVERSITY**



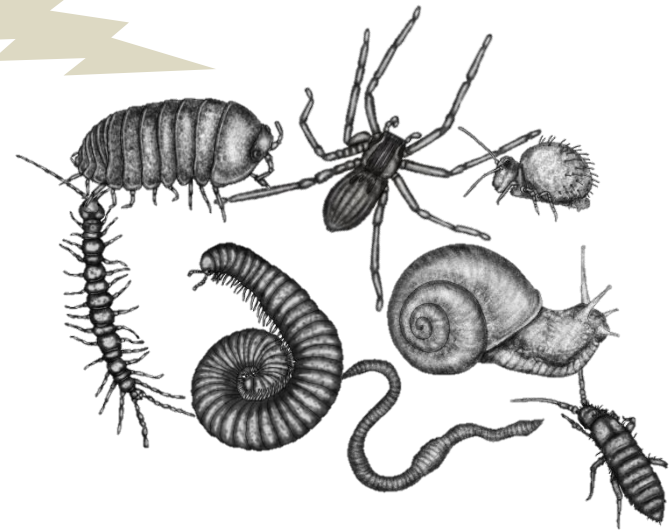
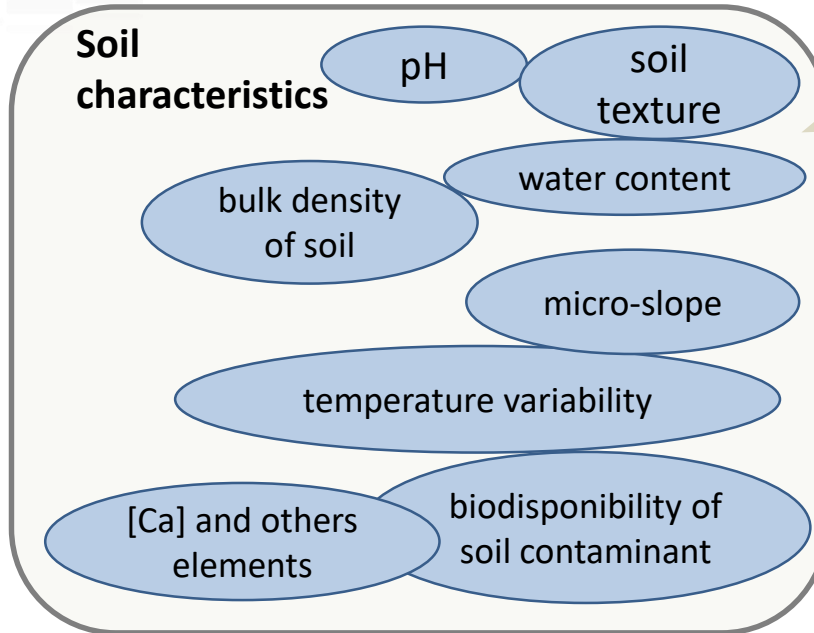
Coleman *et al.*, 2004

Lavelle *et al.*, 2006

Blouin *et al.*, 2013

Context

Usual driven factors of soil invertebrates communities



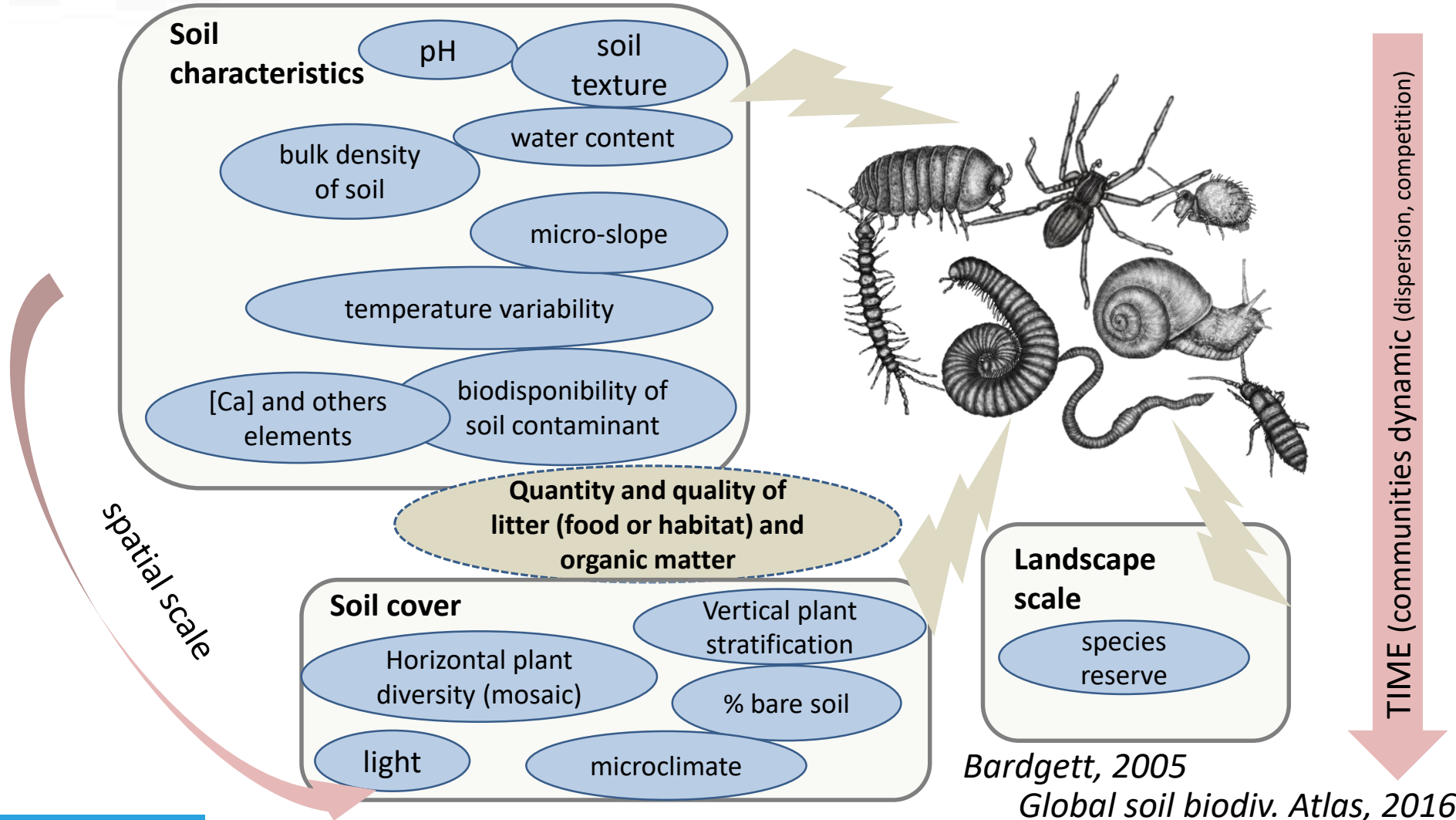
TIME (communities dynamic (dispersion, competition))

Bardgett, 2005

Global soil biodiv. Atlas, 2016

Context

Usual driven factors of soil invertebrates communities



Scientific approach

What about the effect of unusual physical and chemical soil properties of urban soils on soil communities?

- Soil properties of urban soils:
 - Presence of natural and anthropogenic materials (*e.g.*, bricks, asphalt, sand, pavements, and demolition wastes) (Morel et al., 2015)
 - Heterogeneous surface relief (microtopography) induces a mosaic of microhabitats evolving with time: patches of bare soils, litter or plant cover, big mounds of different contaminated or uncontaminated materials that could be poor or rich of nutrients, acidic or alkaline.



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- ***In this way, from an ecological perspective, Urban Soils might provide a high level of biodiversity service because they offer a wide variety of habitats across time.***

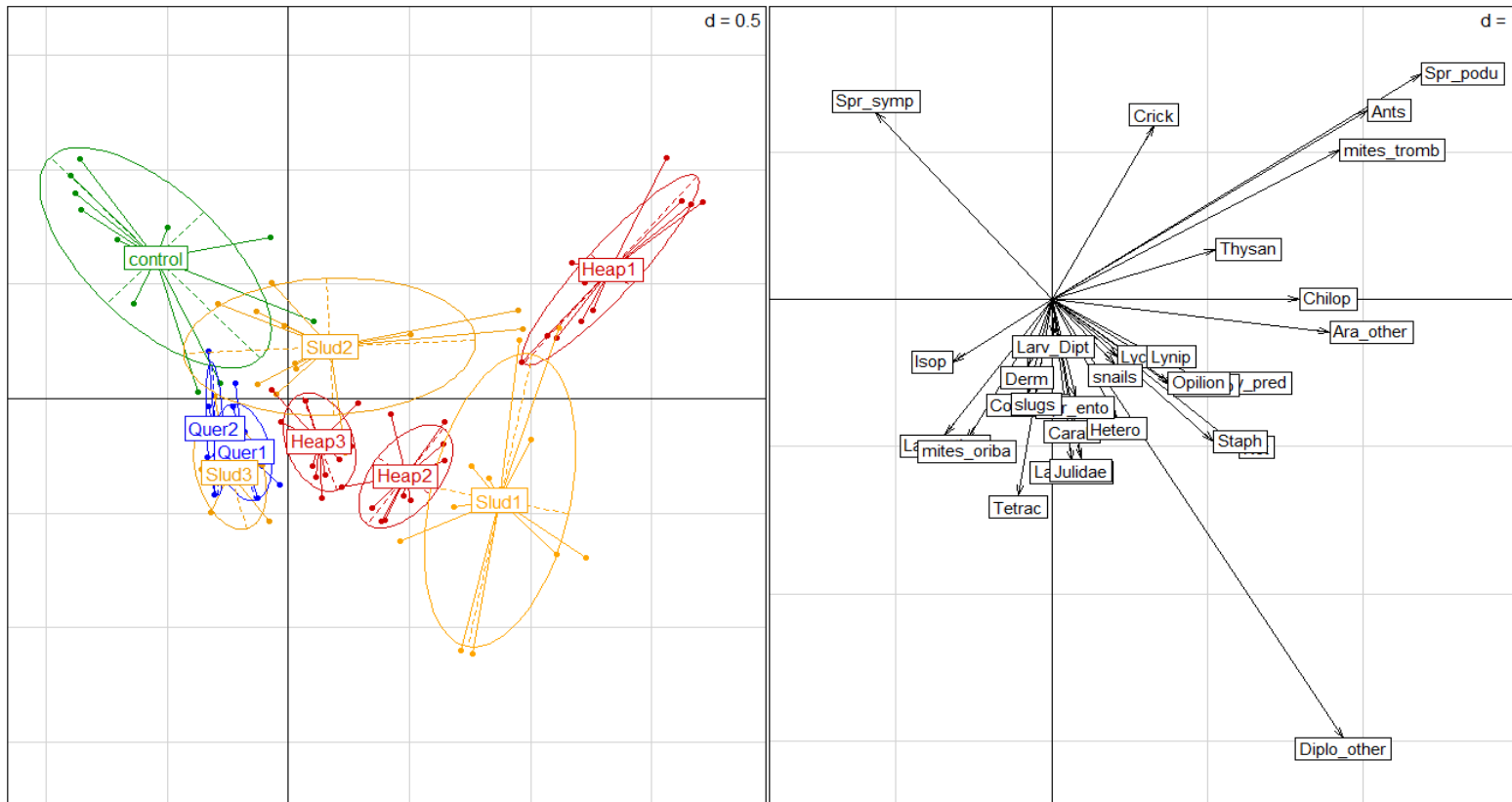


TIME EFFECT: ecosystem evolution

Examples of results: soil communities description in urban soils

In situ study of invertebrates communities of 9 polluted birch forests in France

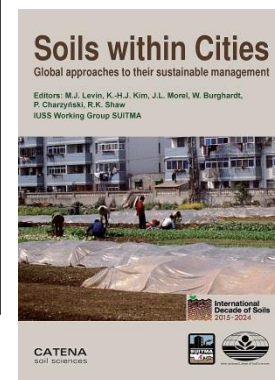
Regulating service of polluted soils : biodiversity



green : control forest / red: spoil heap sites / blue : derelict queries gravel and sand
orange : sludge pond / First axis : 25 % and second axis : 16 %; Monte Carlo test N = 1000 randomizations, p= 0.001

➔ **Difference of community structure for each type of Urban sites**

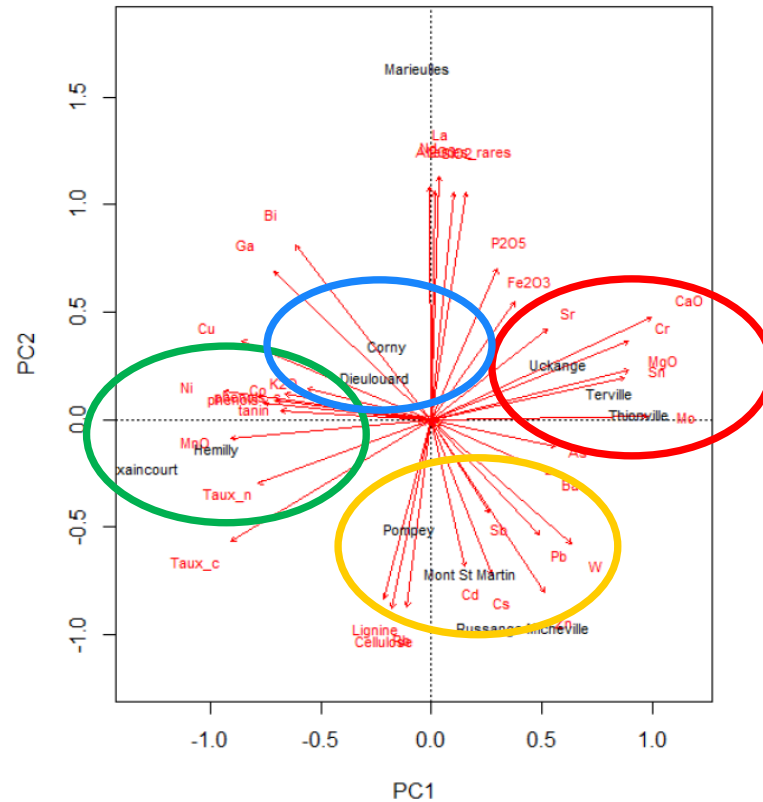
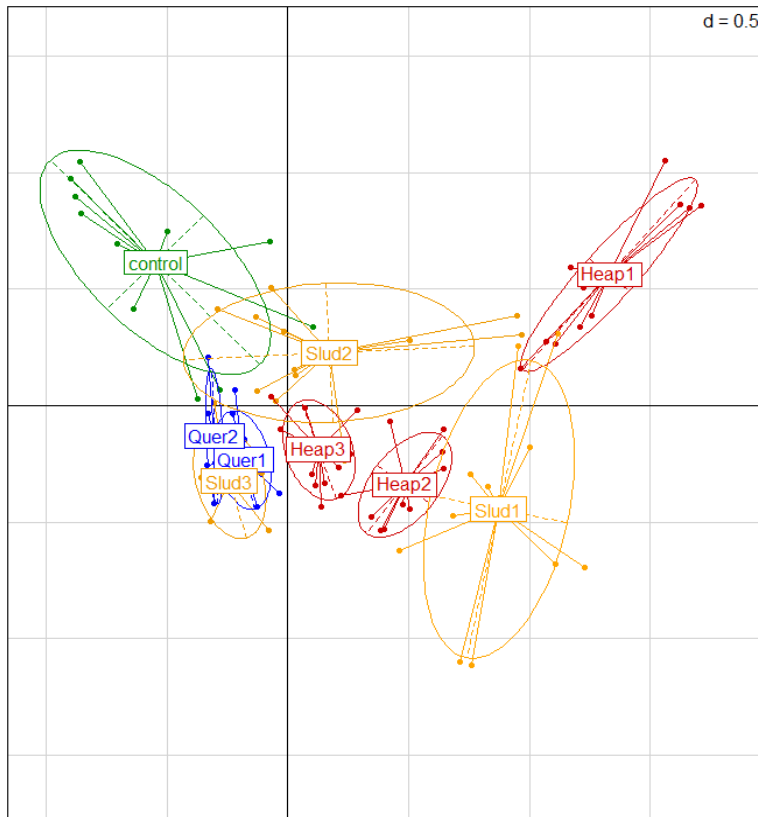
Auclerc, 2017



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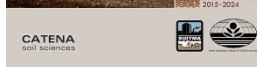


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➔ **Impact of litter quality on soil community structure**

Auclerc, 2017

s within Cities
aches to their sustainable management
with: K.-M.J. Kim, J.L. Morel, W. Burghardt,
F.K. Shaw
Group SUITMA



Examples of results: soil communities description in urban soils

In situ study of detritivores in a polluted forest (sludge pond)

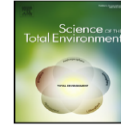
Regulating service of polluted soils : biodiversity and its decomposition function



Contents lists available at ScienceDirect

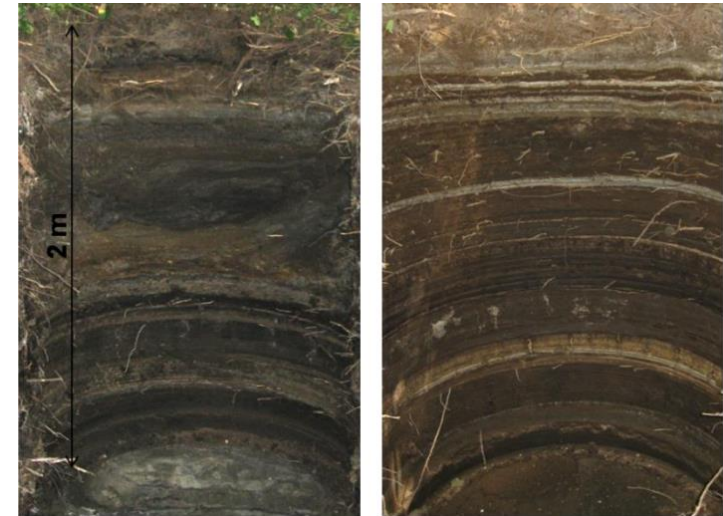
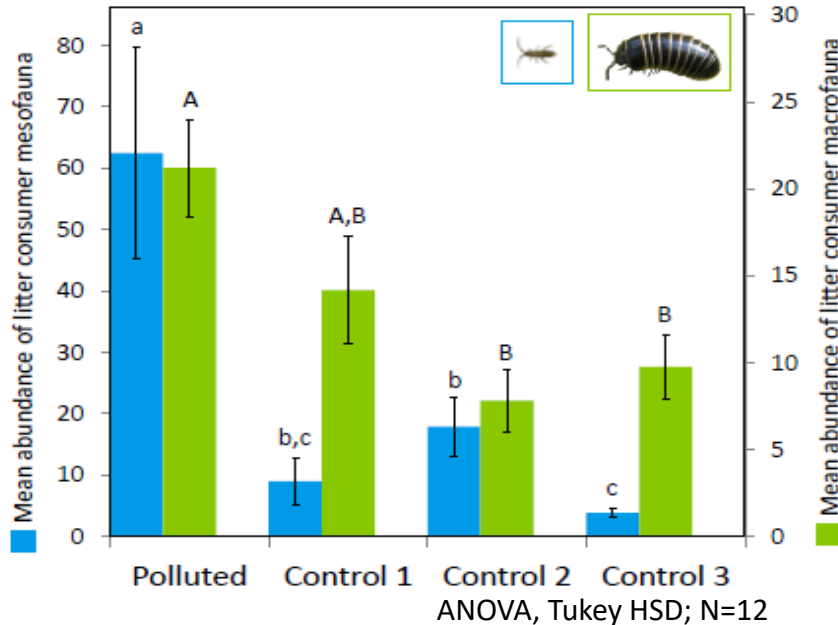
Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv



Litter chemistry prevails over litter consumers in mediating effects of past steel industry activities on leaf litter decomposition

Pierre Lucisine^a, Antoine Lecerf^b, Michaël Danger^a, Vincent Felten^a, Delphine Aran^a, Apolline Auclerc^c, Elisabeth M. Cross^a, Hermine Huot^c, Jean-Louis Morel^c, Serge Muller^a, Johanne Na



Soil	Huot, 2013
pH	7.8 (0.1)
CEC (cmol ⁺ ·kg ⁻¹)	60.7 (3.7)
Carbonates (mg g ⁻¹)	90 (23)
Organic carbon (mg g ⁻¹)	146 (16)
Nitrogen (mg g ⁻¹)	9.3 (1.1)
Phosphorus (mg g ⁻¹)	3.1 (0.1)
Cadmium (µg g ⁻¹)	73 (8)
Lead (µg g ⁻¹)	15,560 (2209)
Zinc (µg g ⁻¹)	19,540 (1915)

- ➔ Detritivores are present and allow the decomposition of litter
- ➔ Adaptation of invertebrates to special abiotic features



Take Home Messages

- **Urban soils can serve as suitable model for integrated ecological studies of communities' assemblage theory across time or soil animals' adaptation to special abiotic features**



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- **But because of the complexity of soil biodiversity itself and the low number of below-ground organisms' investigations, (i) the study of Urban Sites as soil biodiversity refuges and (ii) the knowledge of the influence of predominant ecological factors on the colonization success of soil organisms, are still lacking**



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→ Work together to have more datas?



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- In a context of an increasing awareness of soil biodiversity decline as ecosystems and World threat (Orgiazzi et al., 2016), the human pressure on biodiversity in the case of Urban Sites reclamation or in city plan has to be seriously investigated

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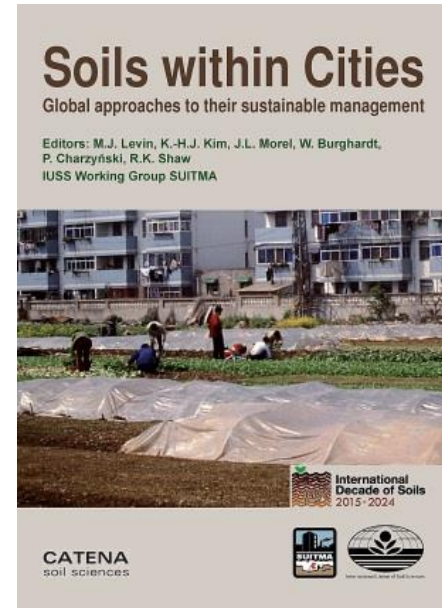
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Today, a major question to answer is which services, Urban Sites have to provide and how **man can help** the biodiversity provide services through its conservation.

Take Home Messages

- In a context of an increasing awareness of soil biodiversity decline as ecosystems and World threat (Orgiazzi et al., 2016), the human pressure on biodiversity in the case of Urban Sites reclamation or in city plan has to be seriously investigated
Today, a major question to answer is which services, Urban Sites have to provide and how **man can help** the biodiversity provide services through its conservation.
- **Ecological engineering: use the adaptation of organisms to special features of Urban Soils for exploring the richness of using biodiversity in sites reclamation for a sustainable approach: Nature Based Solutions & Functional Biodiversity**

Thanks for your attention

Questions?



9.2. Regulating services provided by urban soils

9.2.3 Biodiversity p.213-220

And a poster....

A study of abiotic, biotic and functional parameters of six derelict soils in the north-east of France - towards a potential use of derelict soils as a resource.

Q. Vincent *et al.*

Material and Methods

Sampling methods of soil invertebrates

