Response of earthworm communities to soil engineering and soil isolation in urban landscapes

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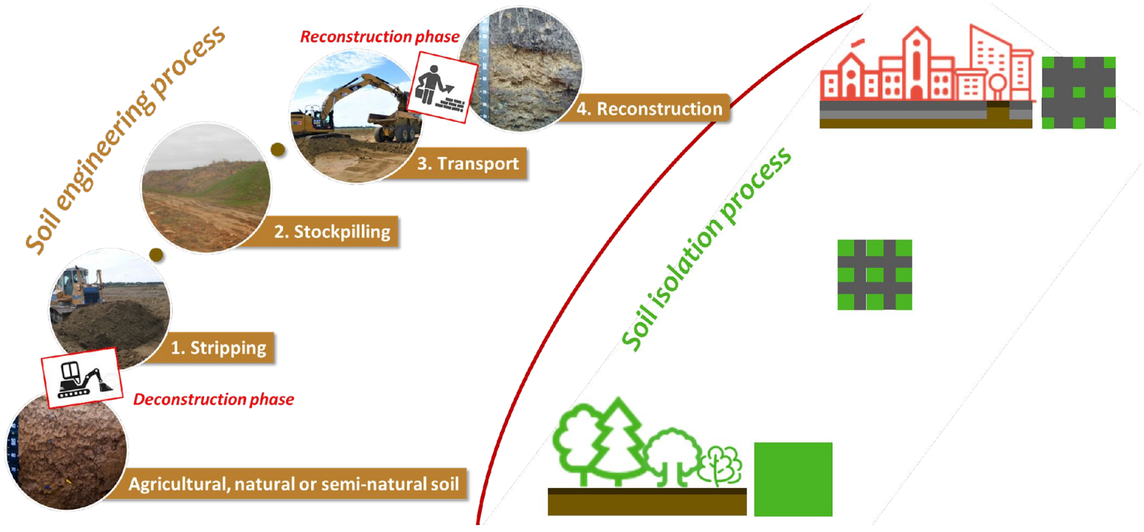
Context & problematics



- Engineered soils provide numerous ecosystem services in urban landscapes, such as water regulation and plant growth (Morel et al., 2015; Blanchart et al., 2018; Calzolari et al., 2020) .
- They are designed to optimize soil physicochemical properties but their biological properties are given little consideration (Damas and Coulon, 2016; Séré et al., 2017).
- In particular, earthworm communities may be highly impacted by soil engineering processes and soil isolation caused by asphalt surfaces separating soils, and in particular roadside soils, from pseudo-natural soils (Scullion et al., 1988; Brun et al., 1991; Fahrig et al., 2003) . In this context, this study aimed to answer two main questions :

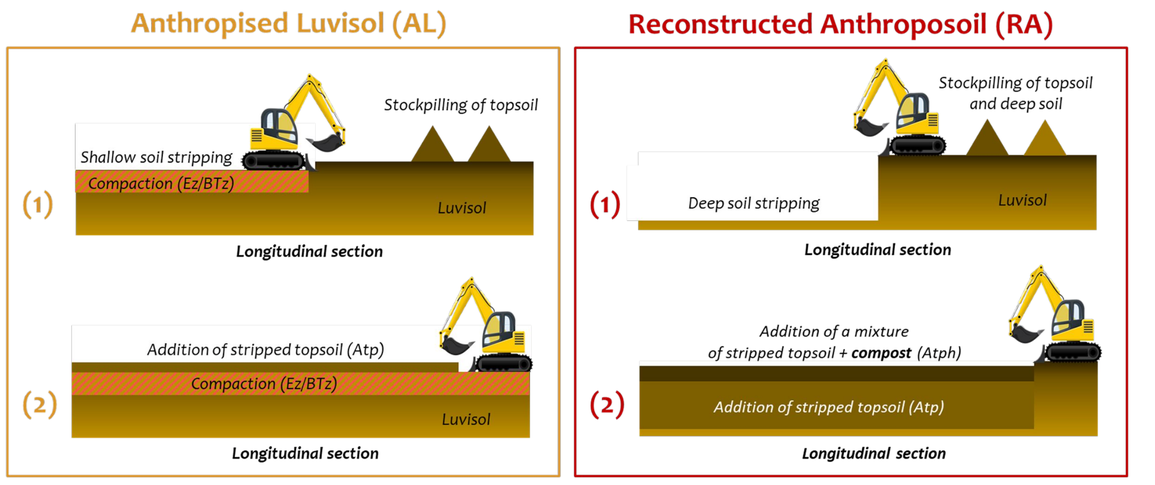
(1) What are the impacts of soil engineering processes on earthworm communities ? (NB: low impacting engineering process = low level of **anthropisation**)

(2) What are the impacts of soil isolation by asphalted surfaces (e.g., sidewalks, roads) on earthworm communities ?

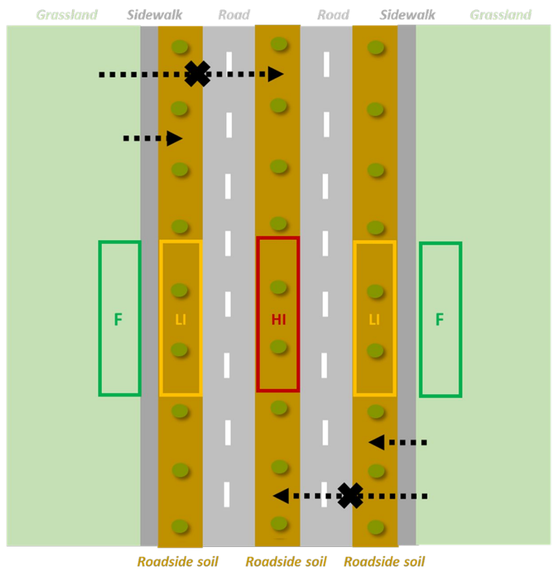
Materials & methods

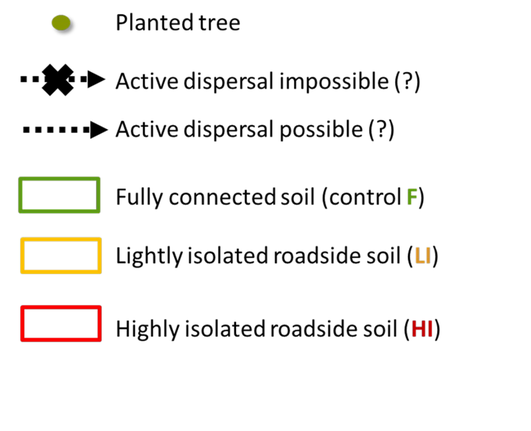
Study sites

- Study conducted in an urban landscape in the suburbs of Paris
- The city studied (Saint-Quentin-en-Yvelines) expands on a substrate characterized by fine loess deposits and most of soils are **Luvisols**
- Soils selected are **linear roadside soils** (respectively 30 and 20-years old) made by following **2 distinct engineering processes :**



- Within each soil engineering process, **2 levels of soil isolation** were defined depending on the **asphalt surface** (a 3 m-sidewalk or a 6 m-road) separating roadside soils from pseudo-natural soils

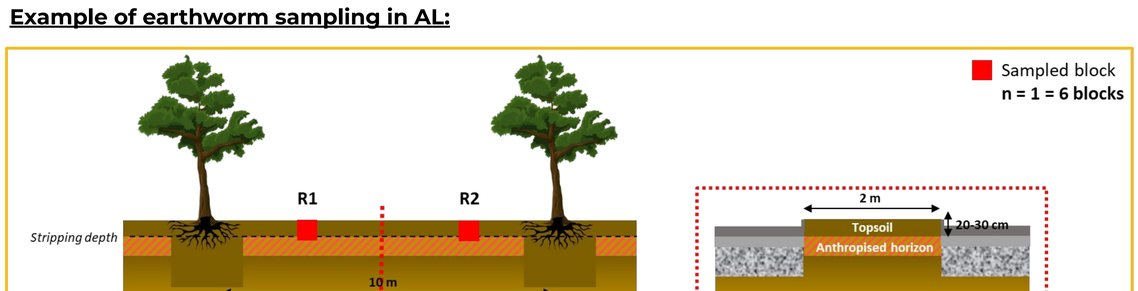




Earthworm sampling

- Each earthworm sampling consisted of extracting **6 blocks** of soil (20 cm × 20 cm × 25 cm, length × width × depth) in 3 consecutive inter-trees and hand-sorting to collect earthworms
- 6 groups were studied : (i) **L-F** associated with AL (n=10), (ii) **AL-LI** (n=10), (iii) **AL-HI** (n=5), (iv) **L-F** associated with RA (n=7), (v) **RA-LI** (n=7), and (vi) **RA-HI** (n=7)

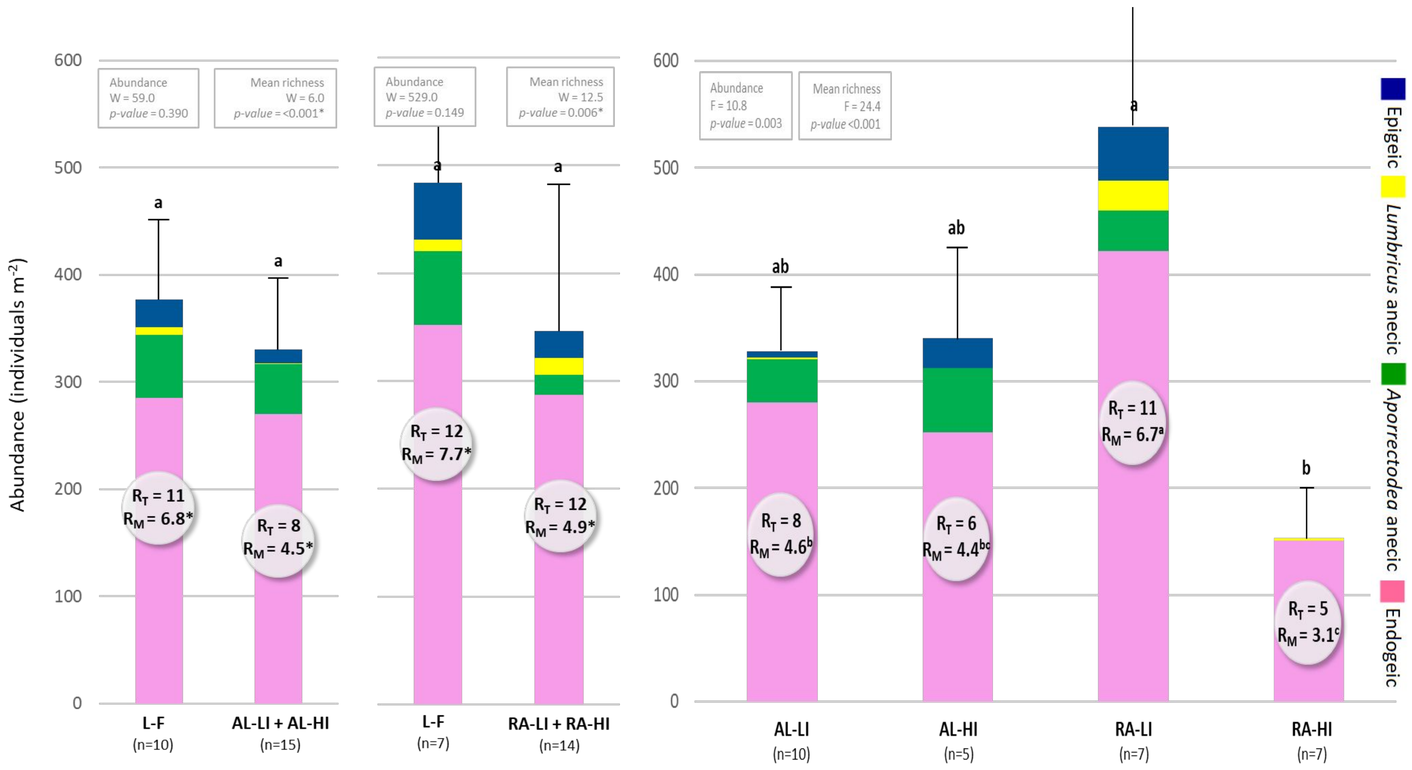
Example of earthworm sampling in AL:



Results

(1) Impacts of soil engineering
Earthworm abundance and richness

(2) Impacts of soil isolation
Earthworm abundance and richness



Highlights

- Soil engineering did not affect **earthworm total abundance** after 20 or 30 years in comparison with nearby Luvisols, but negatively impacted **total species richness**
- Soil isolation did not impact **earthworm communities** of Anthropised Luvisols
- Roads had a negative effect on **earthworm communities** of Reconstructed Anthroposoils
- Epigeics and *Aporrectodea* anecics were absent from highly isolated Reconstructed Anthroposoils

For more details see *: Maréchal, J., Hoeffner, K., Marié, X., Cluzeau, D., 2021. Response of earthworm communities to soil engineering and soil isolation in urban landscapes. Ecological Engineering 169, 106307.*

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