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Assessment of the abundance and diversity of soil macrofauna in urban green spaces in Lubumbashi (Haut-Katanga, D.R. Congo)

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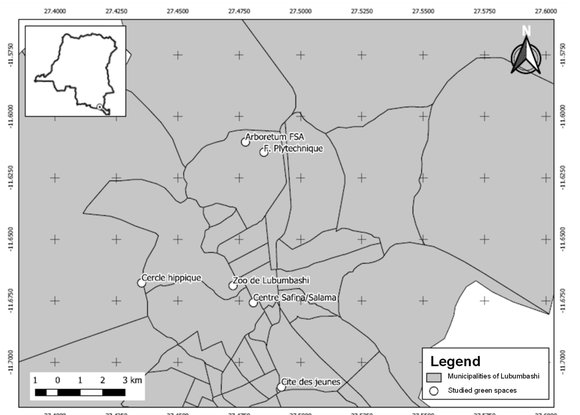
Context

- The functioning of cities disrupts the life of the fauna and flora of urban green spaces. It causes alterations in ecosystem functions and biogeochemical cycles in urban environments (Ferreira et al. 2018).
- Soil macrofauna (SMF) provide many functions by directly or indirectly influencing soil processes in urban environments (e.g. relationship between earthworms and soil aggregation;) (Pey et al., 2013). Thus, SMF contribute to the provision of ecosystem services and are of great interest for conservation (Decaëns et al., 2006).
- Faced with the rapid urbanization that African cities are experiencing, filling the knowledge gap for the conservation of urban soil biodiversity and its related ecosystem services is urgently needed to address complex environmental issues.
- The objective was to assess the impact of vegetation degradation on the abundance and composition of SMF in urban green spaces in Lubumbashi; while aiming to answer the following questions:
  1. Is the presence of vegetation a factor influencing the abundance of SMF ?
  2. Does the taxonomic composition of the macrofauna vary according to the degree of revegetation of the soils of the green spaces?

Methodology

1. Green spaces studied

Six green spaces where at least one third of the total area is covered by trees and shrubs



2. Sampling and observation

Sampling of SMF using the Tropical Soil Biology and Fertility method (TSBF ; Swift & Bignell, 2001) at the start of the dry season (2020)

Bare soil (BS) X Vegetated soil (VS)

Extraction and sorting of the soil monolith. © Grace Mashagiro (2020)

3. Identification of SMF

Identification and classification using a binocular magnifying glass and keys

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Earthworms (OPVT, 2014)

Termites (Bouillon & Mathot, 1965)

Ants (Passera & Aaron, 2005)

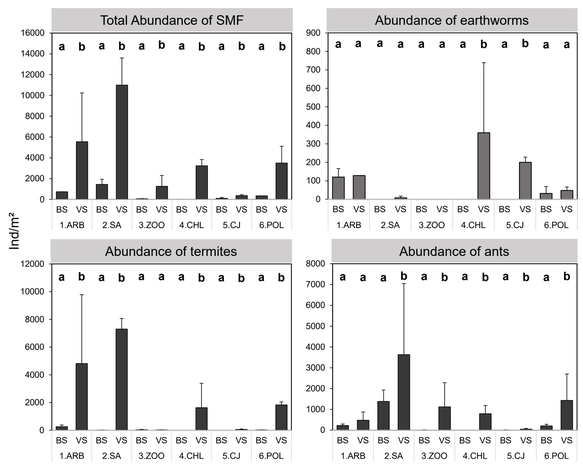
Determination of the abundance of each sample by manual counting

4. Statistical analyses

- **t-test**: Comparison of the abundance between vegetated soils and bare soils for each site individually
- **PCoA**: Characterization of the variation in taxonomic composition of macrofauna between sites and soil modalities
- Determination in % of the dominant taxonomic group for each site individually

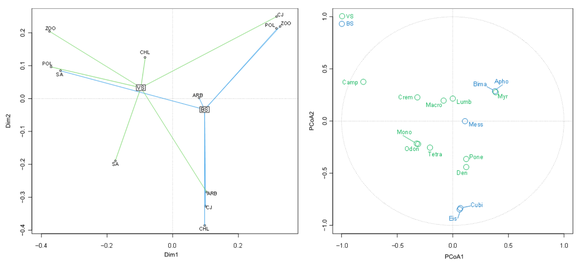
Results

1. Abundance of MFS in the green spaces studied



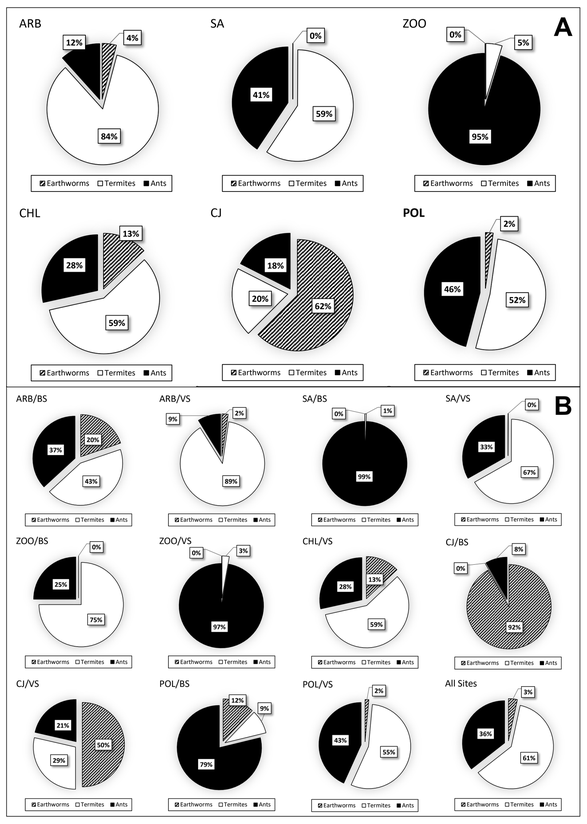
- Within each site, the average total abundance of SMF is significantly higher under VS than under BS.
- The proportion of SMF abundance represented by VS ranges from 100% (CHL) to 76.7% (CJ).

2. Variation in taxonomic composition of SMF between sites and soils



- VS which presents a different fauna from BS (negative coordinates of axis 1) are characterized by the following taxa: *Camponotus pennsylvanicum*, *Crematogaster scutellaris*, *Macrotermes sp.*, *Lumbricus sp.*, *Tetramorium caespitum*, *Monomorium propodeum*, *Odontermes sp.*
- BS are characterized by the following taxa: *Eisenia sp.*, *Bimastos sp.*, *Cubitermes sp.*, *Messor sp.* and *Aphoenogaster sp.* (positive coordinates of axis 1).

3. Taxonomic composition of SFM in the green spaces studied



- 3 sites dominated by termites (ARB, SA, CHL), one site dominated by ants (ZOO), one site dominated by earthworms (CJ) and one site with codominance of ants and termites (POL).
- Within the sites, significant differences in the relative abundance of the different taxonomic groups of macrofauna are observed between VS and BS, with the exception of POL.

Conclusion

- The presence of urban green spaces contributes to improving the biological quality of the soil:
  (a) Presence of vegetation improves soil fertility and promotes the development of SMF.
  (b) Conversion of green spaces to bare soil leads to a drastic reduction in the abundance and diversity of SMF as well as the loss of soil fertility.
- In view of these results, urban green spaces of Lubumbashi should be preserved and rehabilitated given the various ecosystem services that they can provide, in particular the improvement of edaphic conditions through the activities of SMF (termites, ants, worms, etc.).

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