Urban woodlands show a distinct community of ants compared to simpler green infrastructures

- Roberto Sepulveda-Mina[1,2], Xavier Paradis[3], Javier Ibarra-Isassi[4], Jean-Philippe Lessard[4], Tanya Handa[1,2,3]

[1]Institut des sciences de l'environnement, Université du Québec à Montréal (UQAM), Montréal - [2]Centre d'étude de la forêt (CEF) – [3]Département des sciences biologiques, Université du Québec à Montréal (UQAM), Montréal – [4]Department of Biology, Concordia University, Montreal

cef
Centre d'étude de la forêt

UQÀM | ISE
Institut des sciences de l'environnement

Urban forests as a nature-based solution

Climate change presents a major challenge to cities that host an increasing human population worldwide (UN, 2020, IPCC 2022)

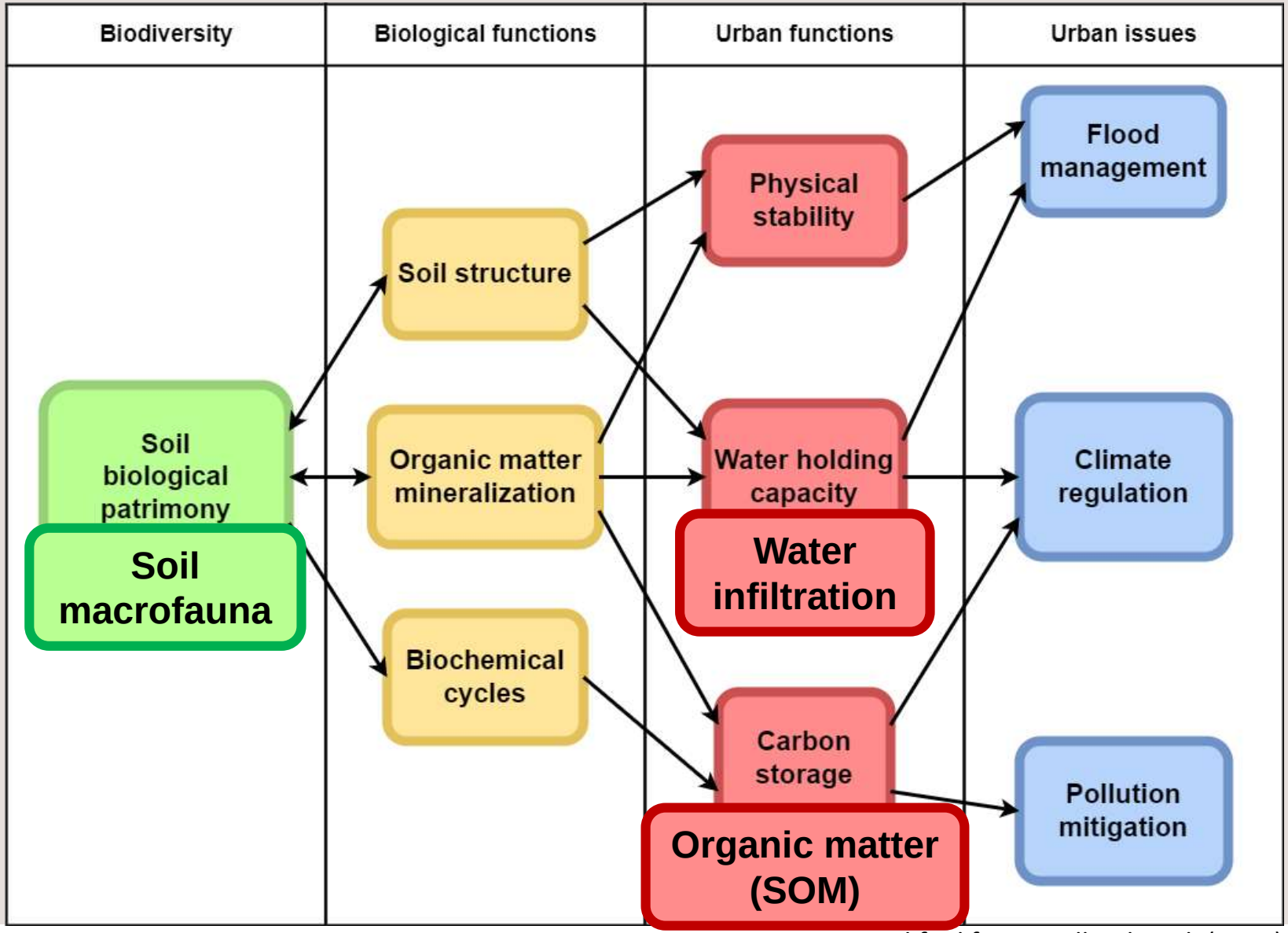
- Ex: Urban heat island effect, flooding from extreme precipitation events

Green infrastructures provide a nature-based solution and co-benefits (IPBES, 2019; Keeler et al. 2019)

- Ex: Storm water management , regulation of temperature, habitat of biodiversity

Complexity of urban forests

Urban forest soils support biodiversity



Modified from Guilland et al. (2018)

Why study ants and earthworms?

Soil engineers

- Create galleries that can influence aeration and hydrology of the soil (Bottinelli et al. 2015; Phillips et al. 2019; Tóth et al. 2020)
- Fragment and disperse nutrients in organic matter decomposition (Ferlian et al. 2018)

- Abundant across all biomes and ubiquitous in cities
- Taxa rich in species with diverse ecological functions

- Mostly exotic species in North America
- Disrupt native biodiversity (Craven et al. 2017; Ferlian et al. 2018)
- Great dispersal capacity in cities (Beauséjour et al. 2015; Shartell et al. 2013)

Objectives and hypotheses

Do ant and earthworm communities vary across a gradient of urban forest complexity?

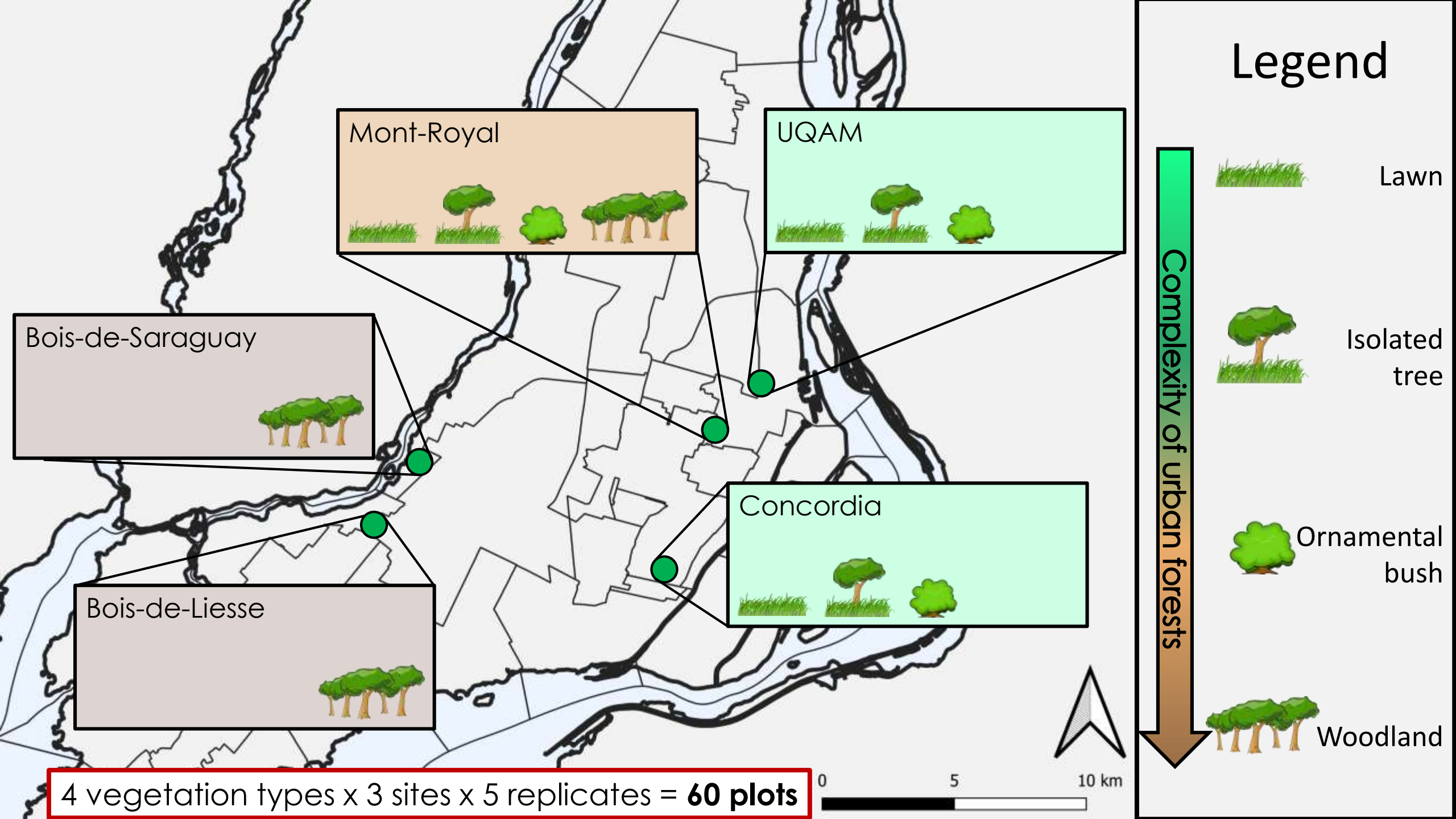
- H1: More complex vegetation types like woodlands will provide different habitats and resources and thus different community composition than simpler green infrastructures (Beninde et al. 2015; Kotze et al. 2022)

Does urban forest complexity influence soil properties?

- H2: The higher quantity of leaves and roots of more complex vegetation types will reduce compaction and increase moisture, organic matter content and water infiltration capacity (Setälä et al. 2016)

Is there a relation between ant and earthworm communities and physicochemical soil properties?

- H3: The burrowing activity of ants and earthworms will increase organic matter content and water infiltration capacity (Amossé et al. 2015; Cammeratt et Risch; 2008; Colloff et al. 2010; Schon et al. 2017)

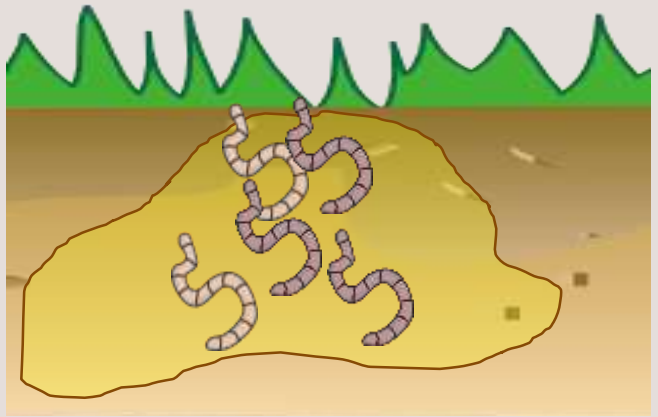


4 vegetation types x 3 sites x 5 replicates = **60 plots**

Soil macrofauna sampling

Pitfall traps

- 2 x 3 days = 6 days
- Ethanol



Mustard extraction

- 2 L mustard solution(10g L^{-1})
- 10 minutes

Measurement of soil properties

Organic matter mass

- Loss on ignition (550°C, 6 hours)

Water infiltration speed

- Textural classes
- Mini disk infiltrometer (Meter Environment)

Moisture

- Fieldscout TDR 300
- Depth at 4 cm

Compaction

- Fieldscout SC 900
- Depth to 10 cm

Temperature

- Hobo data loggers

A lot of invertebrates were sampled …

To see more… look at our poster!
Thursday 13h30 – 15h00
VIP guests: Collembola

Ant species occurence varies with vegetation type

A total of **41 species** representing **17 genera** were sampled

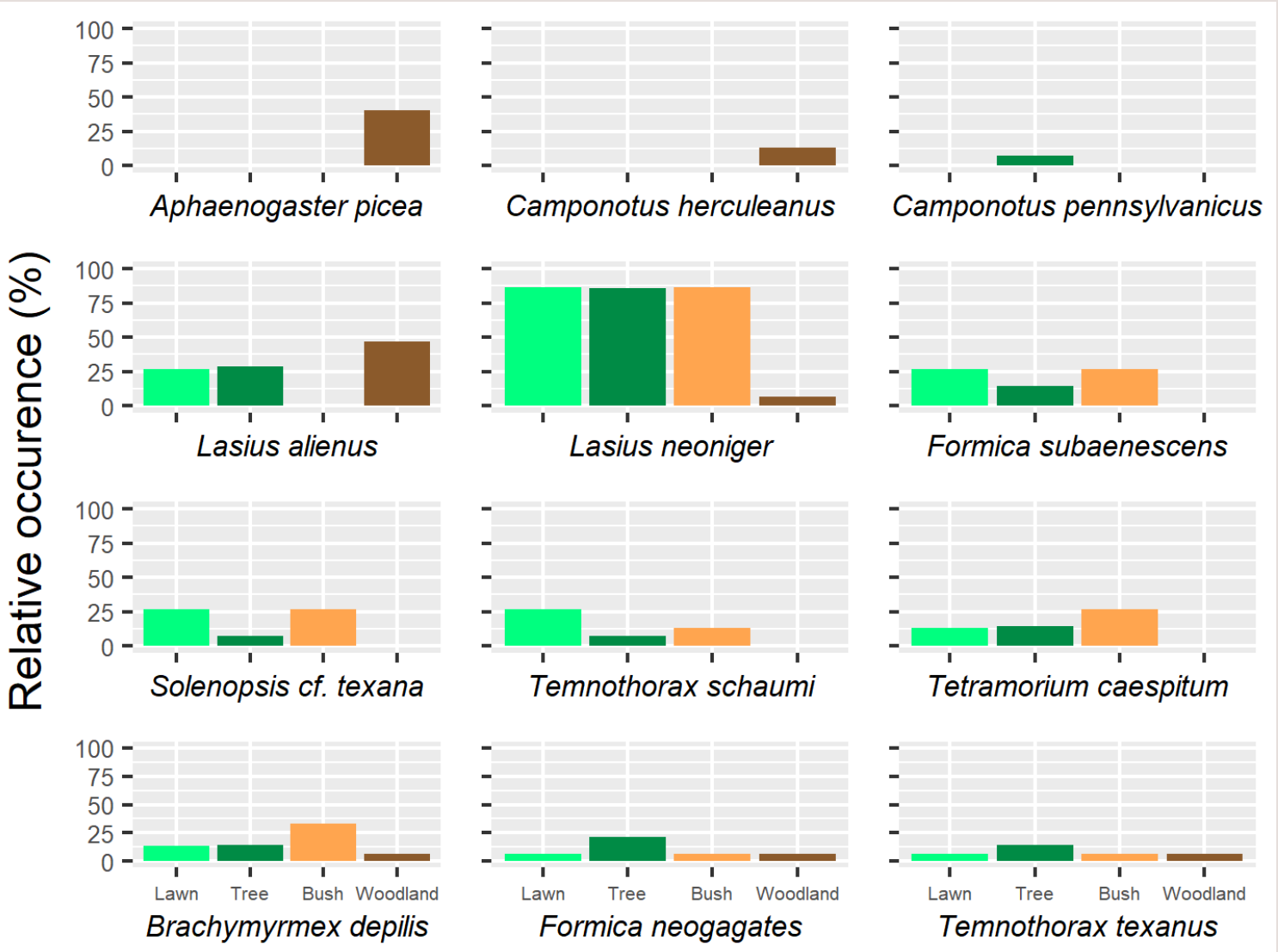
- 13 species sampled in >5% of the plots
- 28 rare species

Lasius neoniger

- most abundant species
- dominant in simpler vegetation
- rare in woodlands

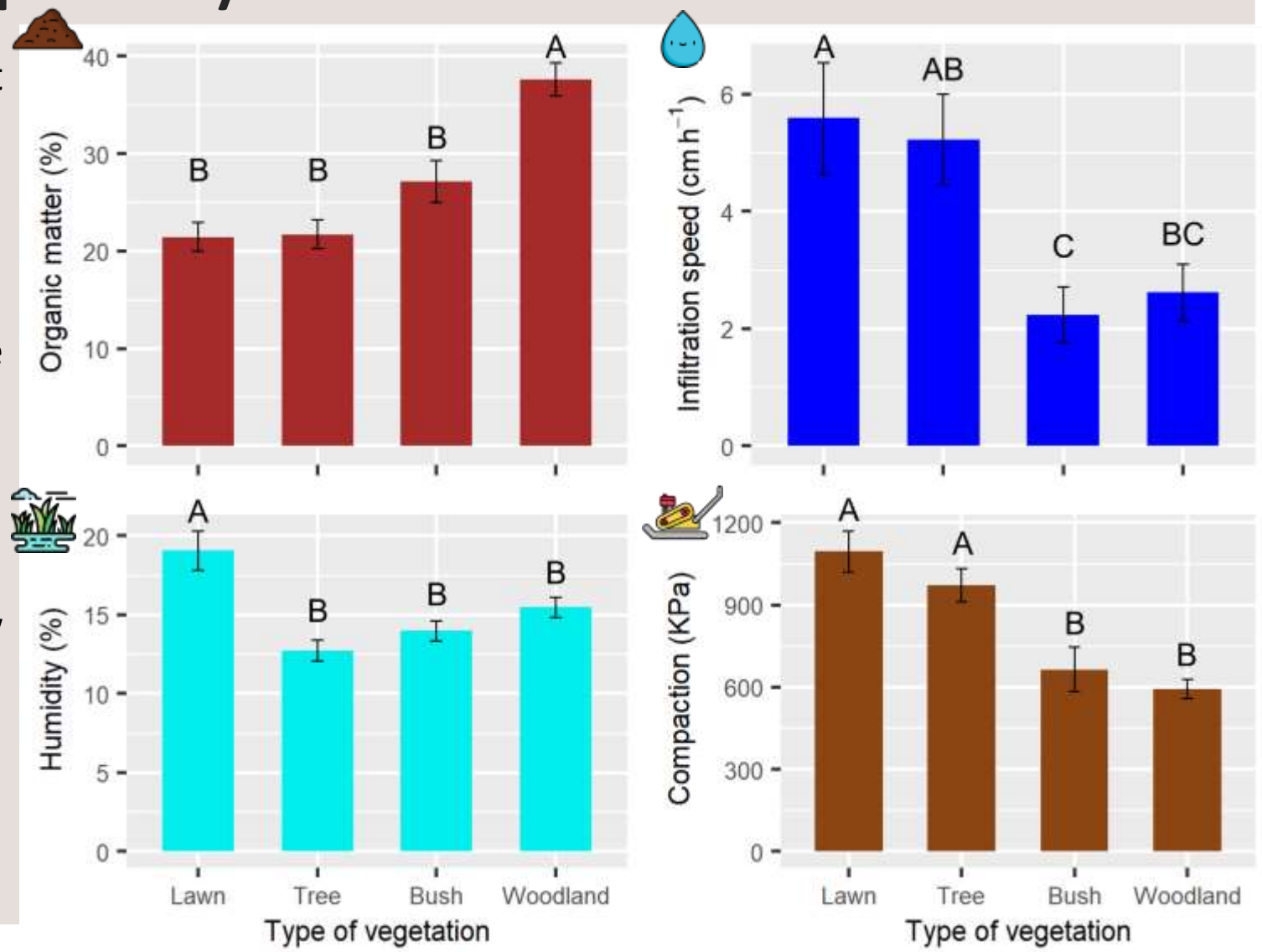
Aphaenogaster picea

- present in woodland only



Soil properties differ between vegetation complexity extremes

- Bushes are similar to woodlands except for organic matter
- In lawns, the presence of a tree reduced soil moisture
- Organic matter and soil moisture show an opposite trend

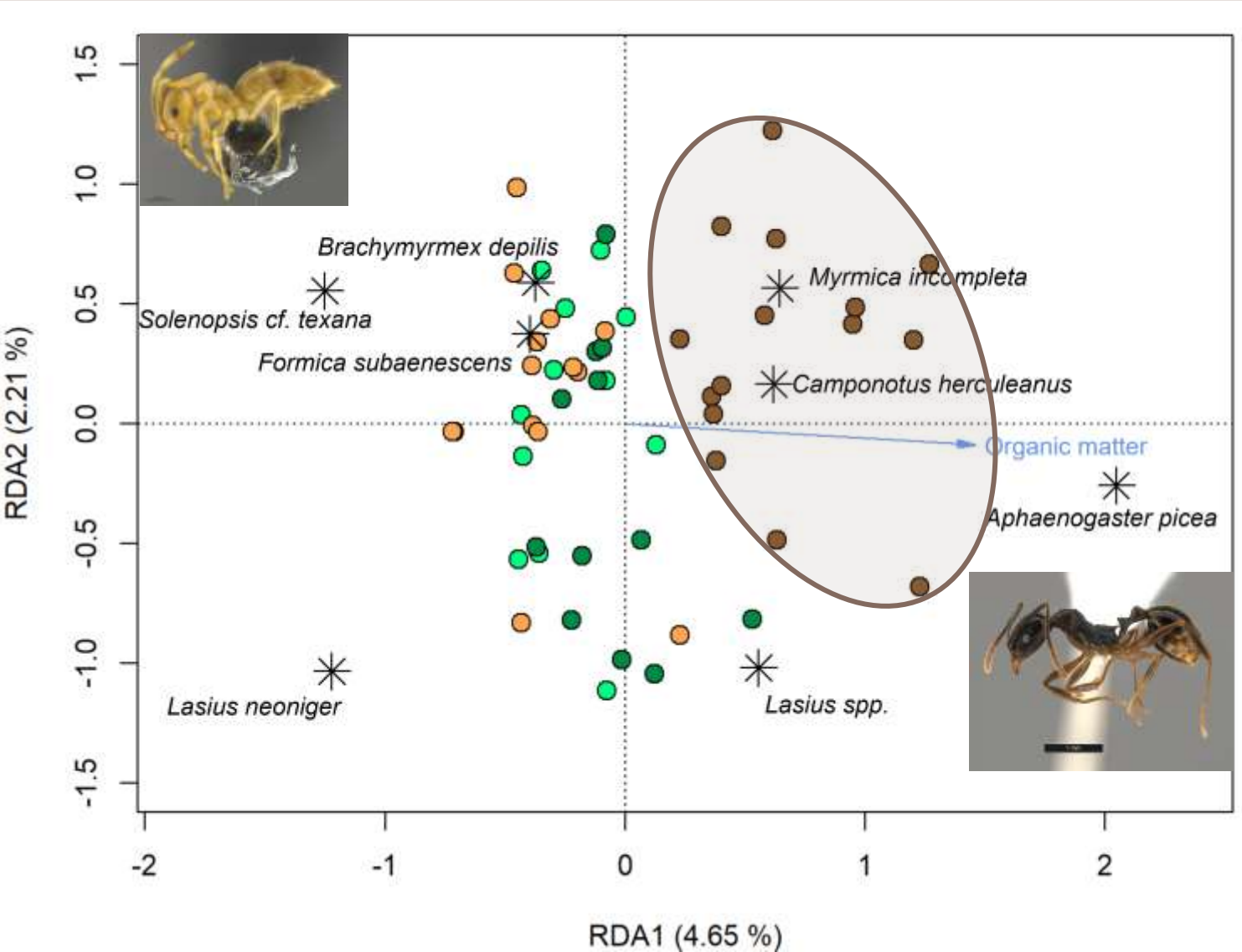


Woodlands are distinct from other vegetation types

Legend

- Lawn
- Lawn + Tree
- Bush
- Woodland

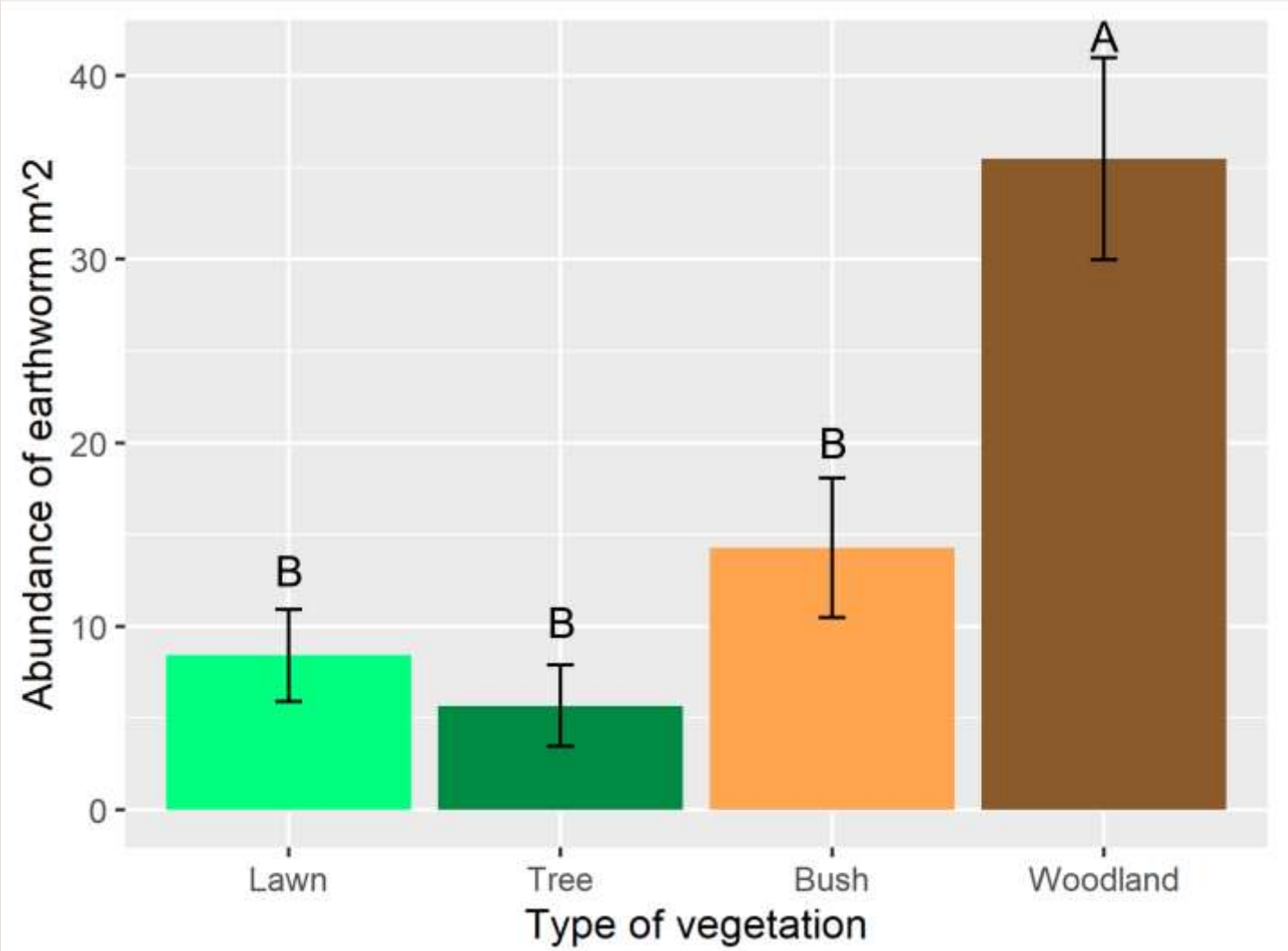
Organic matter explains ant communities



Legend

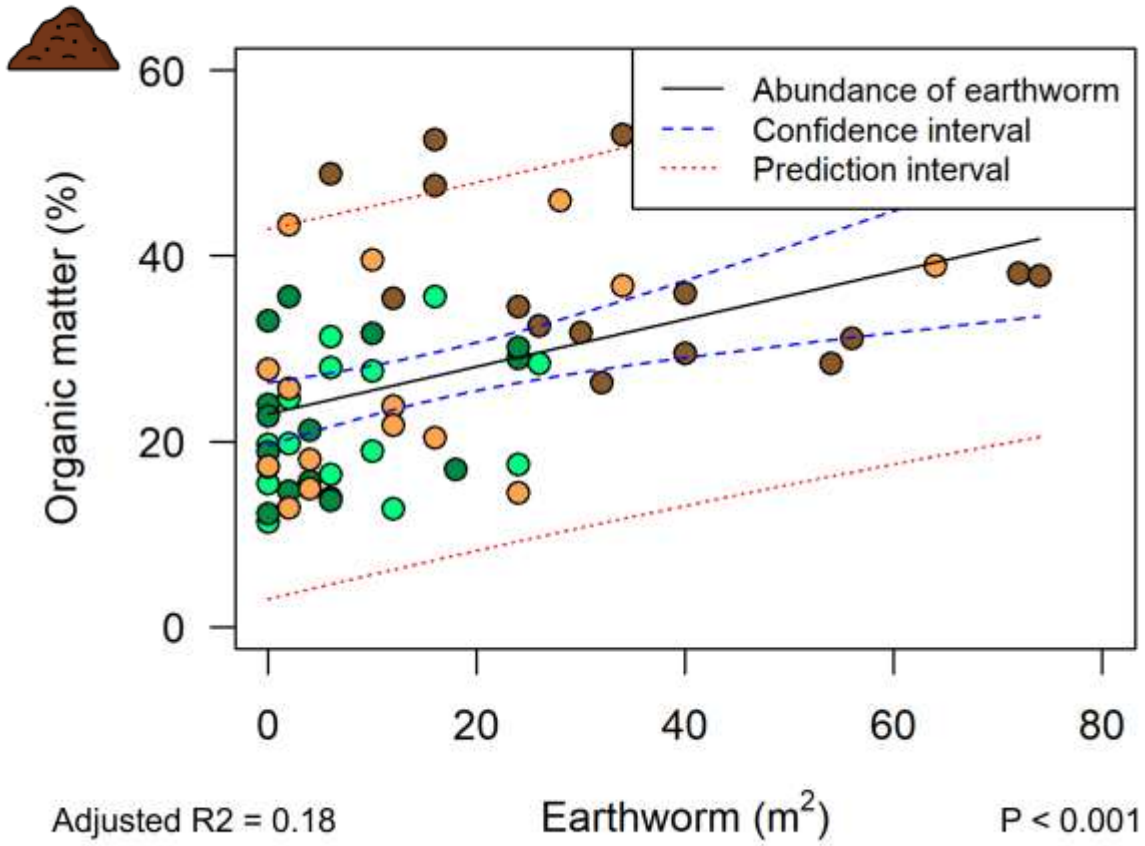
- Lawn
- Lawn + Tree
- Bush
- Woodland

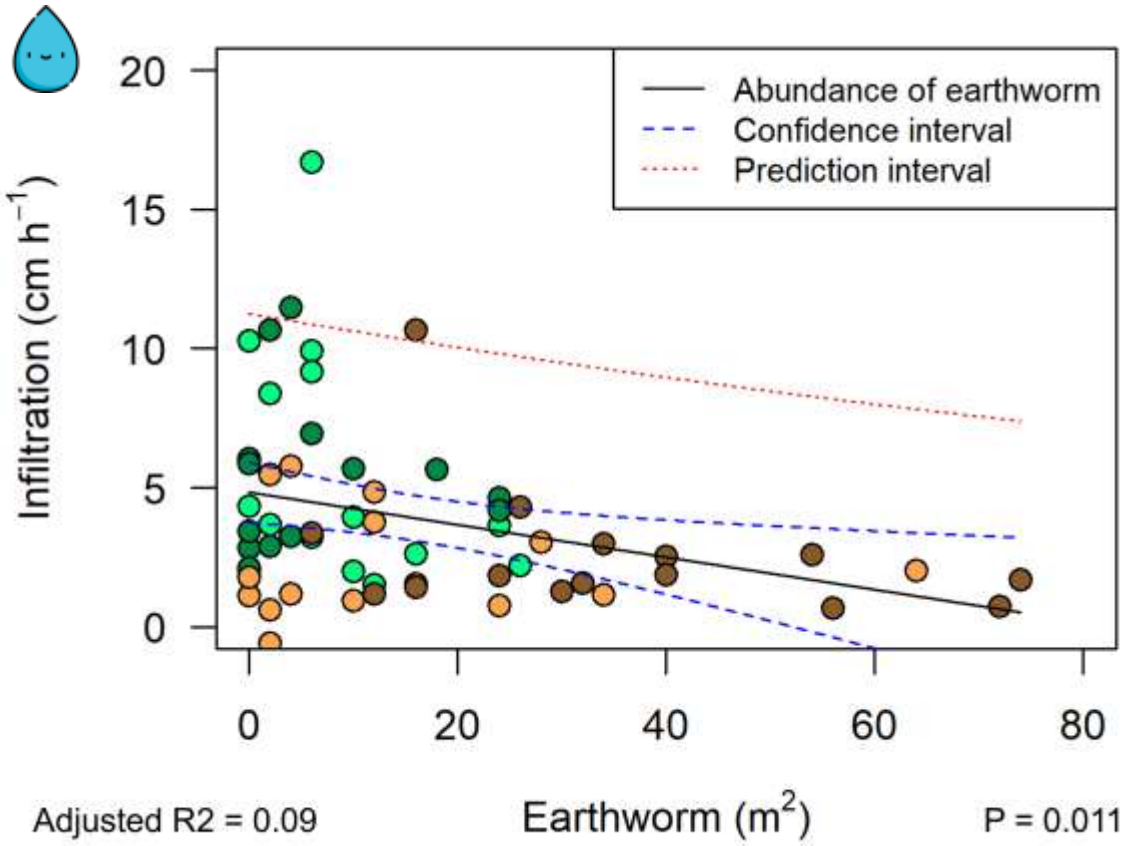
Earthworms are more than two to three times as abundant in woodlands than other vegetation types



Organic matter and infiltration are weakly correlated with earthworm abundance

Many plots with absence of earthworms





Our hypotheses?

H1: More complex vegetation types like woodlands will provide different habitats and resources and thus different community composition than simpler green infrastructures

Woodlands are distinct from simpler vegetation types

H2: The higher quantity of leaves and roots of more complex vegetation type will reduce compaction and increase moisture, organic matter content and water infiltration capacity

H3: The burrowing activity of ants and earthworms will increase organic matter content and water infiltration capacity

No strong relation between earthworm burrowing activity and soil properties.

Recommandations for urban forest managers

- Conserve and restore residual woodlands
- Consider increasing the use of ornamental shrubs in the urban landscape
- The various green infrastructures of urban forests should be better distributed and seen as a solution

Research perspectives

- Assess burrowing activity of 41 species within the sampled ant community
- Molecular tools to identify juvenile earthworms
- Consider ant colonies and colony distance in relation to sampling plots
- More complete sampling throughout the growing season

Acknowledgements

- Laboratoire Handa
  - Essivi Gagnon Koudji
  - Florentin Jaeger
  - Laura Jeanne Raymond-Léonard
  - Jérémi St-Pierre

- Authorization to sample

UQÀM
Université du Québec à Montréal

Université Concordia University Montréal

Montréal

cef
Centre d'étude de la forêt

CRSNG
NSERC