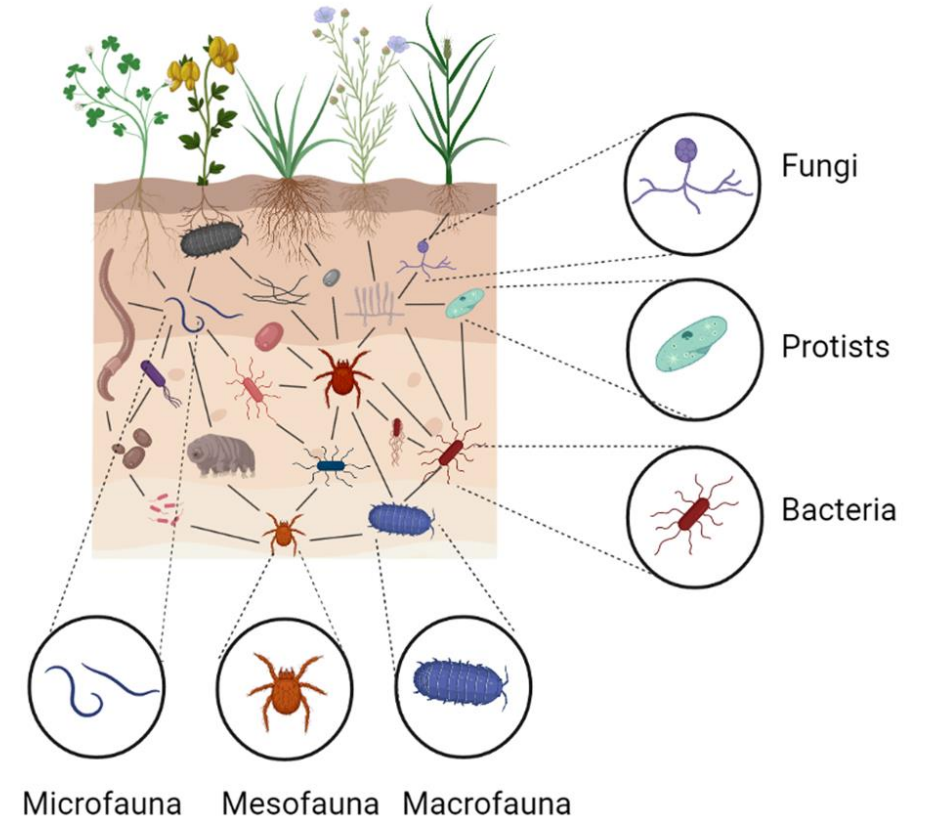


# 1: Soil food webs and soil health: What do we know and the way forward

This topic focuses on compiling and summarizing the current data and knowledge on soil food webs, how they impact ecosystem functioning, resilience to global change factors, soil health, soil conservation...

It consists of:

- In-depth literature review
- Analyzing and piecing together the results we obtained from past experiments
- Potential metanalysis
- Creating conceptual figures that exemplify the processes involved based on your research
- Writing a thesis which could eventually be turned into an 'opinion' or 'metanalysis' paper with suggestions about how to advance this field of research.



## This topic is for you if:

- you're someone who loves interpreting scientific results, connecting different pieces of knowledge, finding patterns and identifying the gaps → or you are interested in learning about it.
- you are interested in creative ways of presenting results in the form of conceptual figures
- you are intrigued about the role of biodiversity of soil organisms and their complex interactions in ecosystem functioning, soil health, conservation and restoration, etc.
- prefer flexible time schedules to work on the thesis
- Contact: [dajana.Radujkovic@uantwerpen.be](mailto:dajana.Radujkovic@uantwerpen.be) or [erik.verbruggen@uantwerpen.be](mailto:erik.verbruggen@uantwerpen.be)

## 2: Can we enhance (soil and plant) biodiversity in natural acidified ecosystems while simultaneously increasing CO<sub>2</sub>-sequestration by applying Si-rich rock powders (SRP)?

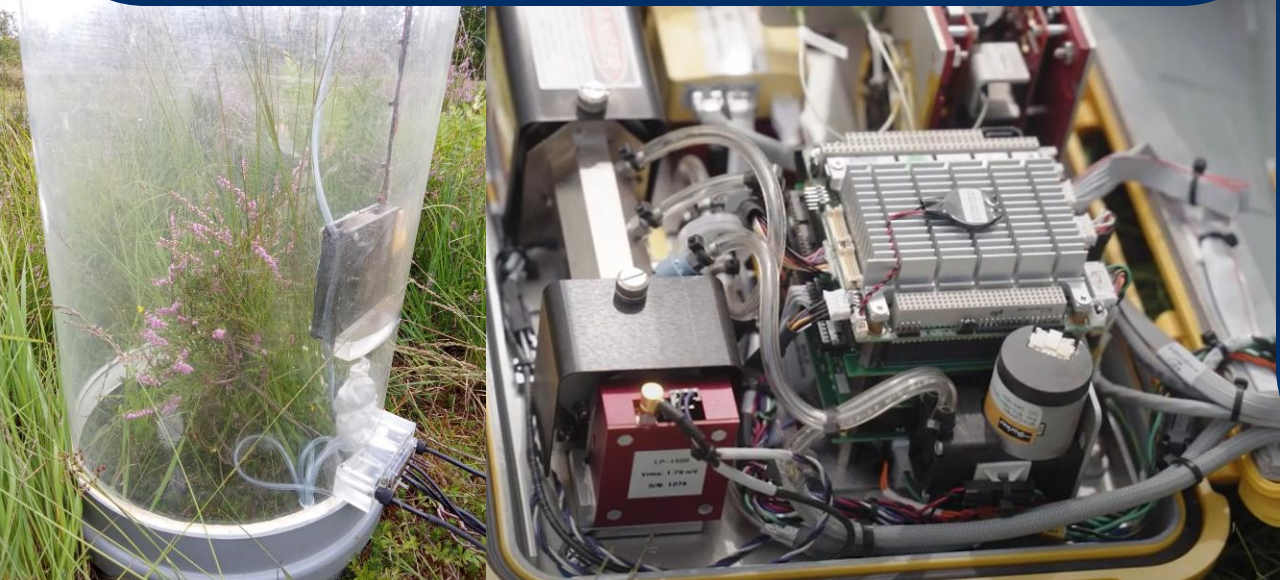
### BACKGROUND

- SRP application (Enhanced Silicate Weathering)  
-> **CO<sub>2</sub>-removal strategy**
- + improves soil quality (pH, nutrients, buffer capacity)  
-> **mitigate soil acidification?**
- **But:** effects on soil chemistry, SOM decomposition, real-time C-fluxes, and microbial and plant community composition in natural ecosystems never quantified

### EXPERIMENT

- Measure real-time C-fluxes (←) upon SRP application across different habitat types with varying SOM contents
- Investigate the soil microbiome's short-term response to SRP using molecular methods (DNA-extraction, PCR, Amplicon sequencing)
- Learn about various statistical methods how to analyse community data
- Conduct field work in “no-access” nature reserve “De Zegge” (↑)

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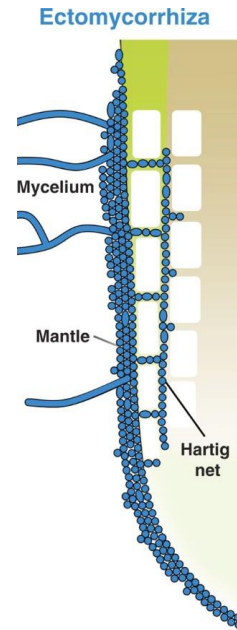
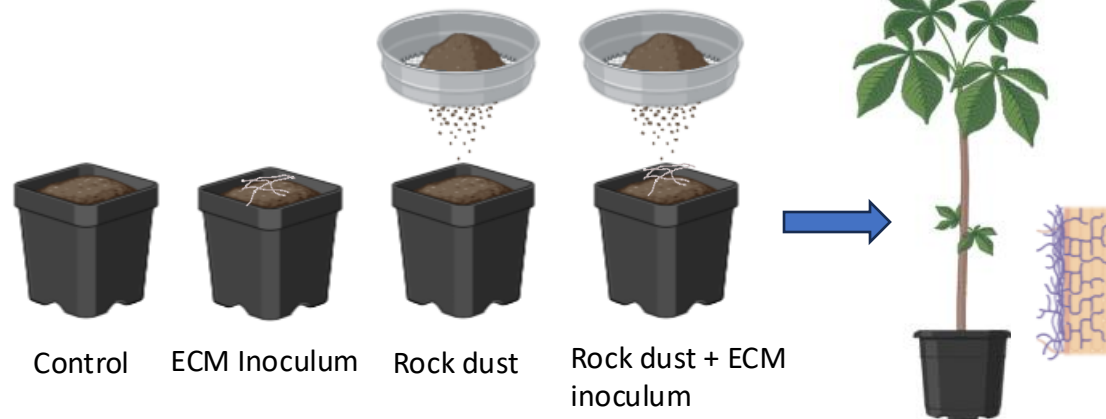


# 3: The unknown effects of silicate rock weathering (SRW) on ectomycorrhiza

## Context:

- Silicate rock weathering:
  - Increases pH
  - Base saturation and CEC
  - CO<sub>2</sub> sequestration
  - Positive effects on tree growth and forest ecosystem health
- Ectomycorrhiza
  - Fungi helping trees and woody plants with water and nutrient uptake,
  - Hartig net
  - Unknown effects of SRW

## Full factorial designs:



## Techniques and skills:

- Experimental setup and designing of mesocosm experiments
- Field experiments in the Netherlands
- DNA metabarcoding analysis
- Statistics
- ...

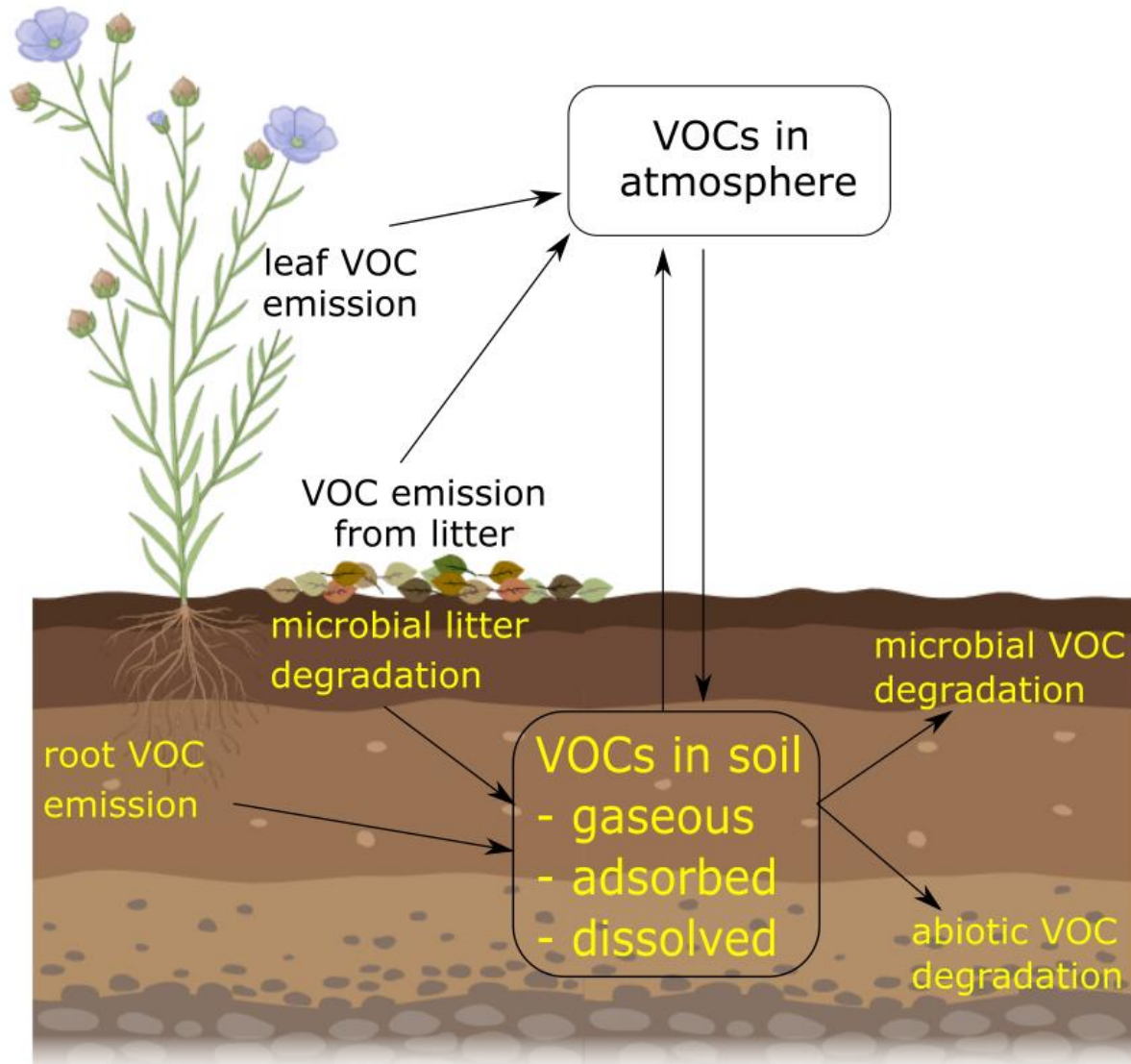
## Field work and tests:

### Field work:

- Possibility to do tree corings
- Mesh bag trials
- Soil chemical analyses
- ...

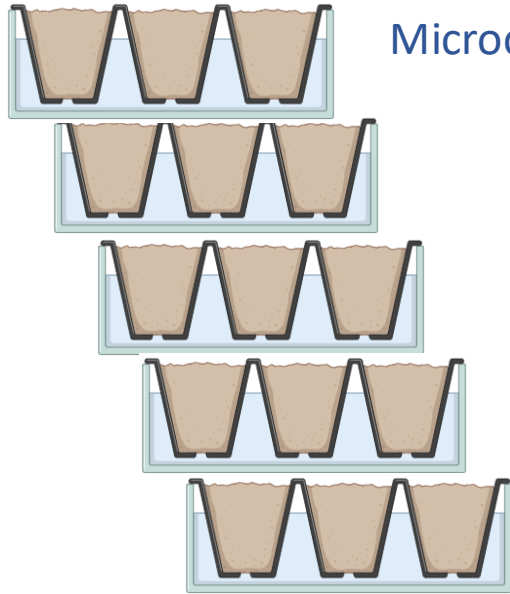
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# 4: The factors responsible for soil VOC emissions: influence on the composition and quantity of volatilome components



- Soil VOC emissions are linked to microbial activity, which affects nutrient cycling, health and functionality of soil ecosystems
  - Depending on the composition and quantity, it could be linked to microbial diversity and abundance, and activity (litter decomposition rates)
  - Soil VOCs play a role in plant-plant and plant-microbe interactions, affecting ecosystem dynamics.
  - Soil VOC emissions contribute to atmospheric VOC levels, which can impact air quality and human health. VOCs can interact with other atmospheric compounds, forming secondary air pollutants
- 
- VOC measurements from soils are challenging, unexpected results, variety of compounds... much to discover!
  - High-end technique (PTR-TOF-MS)

# The factors responsible for soil VOC emissions: influence on the composition and quantity of volatile components



Microcosms with combinations of:

- soil textures
- litter types
- Microbial inoculum from contrasting sites (oak forest vs. grassland)
- pH levels
- moisture levels
- temperature
- more?

Our objective is to disentangle the implication of each of the factors in the VOC fluxes, e.g.:

- general decomposition processes
- soil property-related
- litter-specific emissions
- suppression, etc.



dr. Miguel Portillo-Estrada  
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Which techniques can you learn?

- Literature research
- Designing the experiment
- Setting up the experiment
- PTR-TOF-MS (proton transfer reaction time-of-flight mass spectrometer)
- PTR-TOF-MS data analysis
- Statistics, etc...
- Soil chemical analysis, texture, pH, etc.

# 5: improving soil biodiversity and functioning through land-use change

- Intensively managed agricultural fields are commonly converted to more sustainable practices such as C-farming or organic agriculture
- Here, we ask whether this is successful in terms of C storage, biodiversity, and/or pesticide residue removal, where success of the latter two may critically impede the first
- Field studies on a current C-farming site, as well as a chronosequence of transition to organic farming
- Focus can be discussed, depending on student's interest and aspirations. Can be more field measurement, or experimentally based. Come talk to us!



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Or

Ivan Janssens  
[Ivan.janssens@uantwerpen.be](mailto:Ivan.janssens@uantwerpen.be)

# 6: **Exploring “Micro-sociology”:** can microbes predict habitat type?

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## Contents of the thesis

- Investigate soil microbial community composition across different N2000 habitat types (DNA)
- Link microbial community data to vegetation community data
- Can we predict habitat type using microbial data?
- Option to conduct field work in “no-access” nature reserve De Zegge (Geel)
- Option of data mining (integration of European datasets)



# 7: Peat moss (*Sphagnum spp*) reintroduction for peatland restoration

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## Contents of the thesis

- (Re-)introduce different species of peat mosses in different peatland habitat types
- Link establishment success to abiotic, microbial and environmental properties
- Field work in “no-access” nature reserve De Zegge (Geel) and Vorsdonkbos (Aarschot)
- Work on the *Sphagnum* microbiome (DNA)





# Other topics could be possible as well

- Come talk if you are interested in the magnificent diversity of soil life, symbiosis with plants, and effects of global change
- Contact me: [Erik Verbruggen@uantwerpen.be](mailto:Erik.Verbruggen@uantwerpen.be)

