

1: Combatting forest soil acidity: interaction effects of enhanced rock weathering (ERW) and ectomycorrhiza

Context:

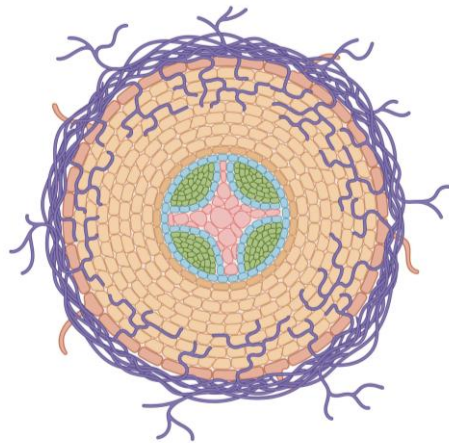
- **Enhanced rock weathering (ERW):**
 - Increases pH
 - Base saturation and CEC
 - CO₂ sequestration
 - Positive effects on tree growth and forest ecosystem health
- **Ectomycorrhiza (EcM):**
 - EcM communities suffer under soil acidity (pH < 4)
 - **Recovery** of communities due to ERW
 - Potential positive effect of EcM on ERW **mineral weathering**

Field & lab work :

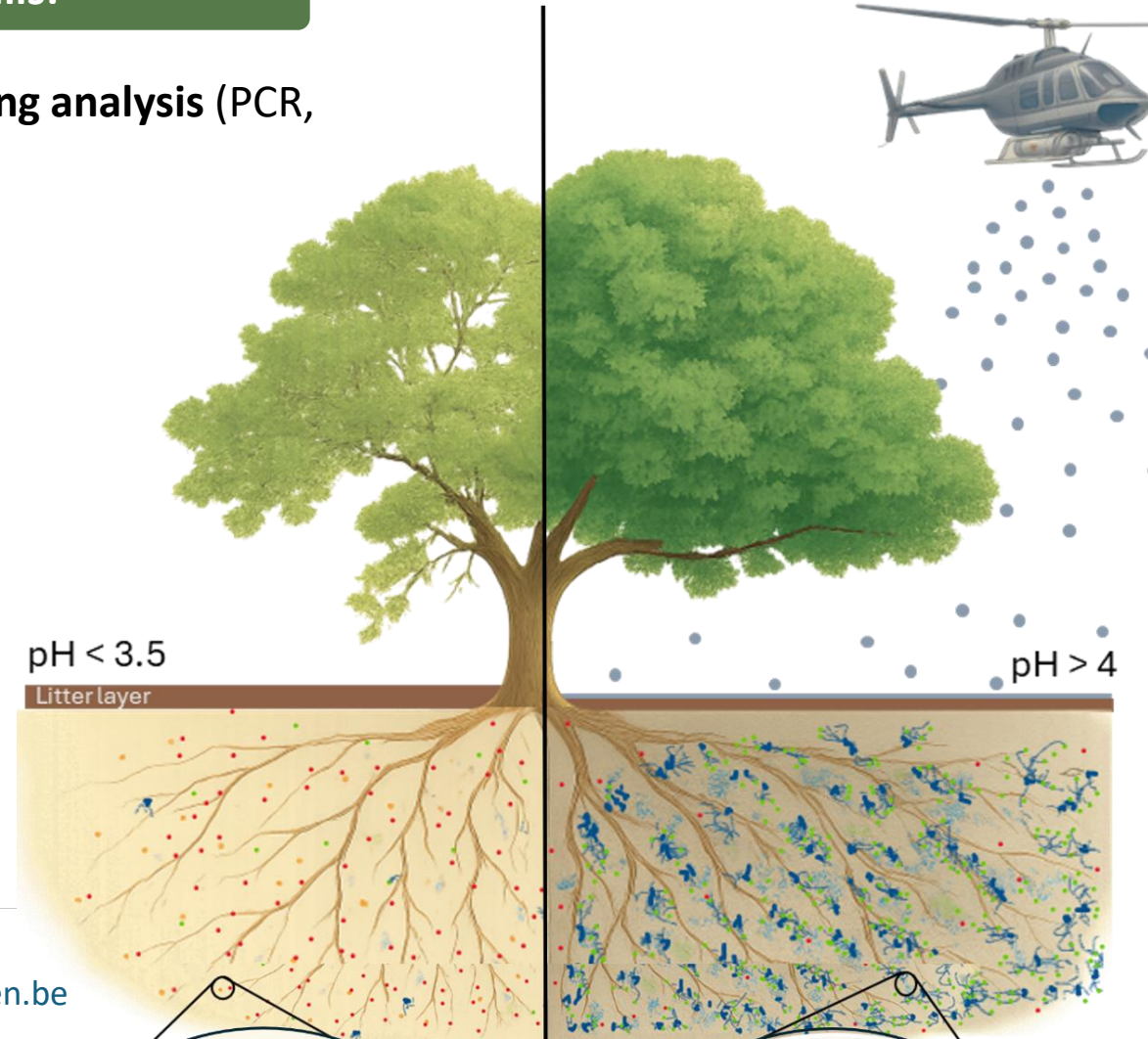
- **Experiments @ N-site**
- Growth chambers
- Field: **Netherlands forests**
- **Molecular lab**

Techniques and skills:

- **DNA metabarcoding analysis** (PCR, Qubit, qPCR, ...)
- CCM
- **Root analyses**
- Tree corings
- Mesh bag trials



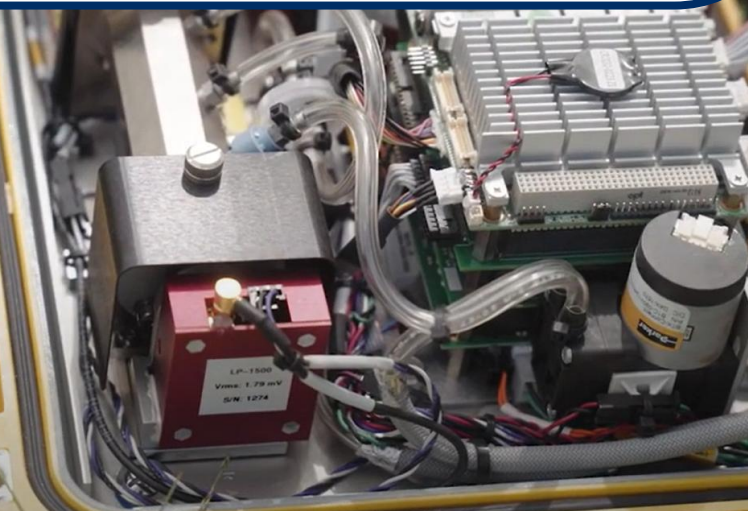
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2: What are the effects of rock dust (RD) application on soil chemistry, the soil microbiome, plant community and ecosystem functioning (decomposition) along a natural organic matter gradient?

BACKGROUND

- Enhanced Silicate Weathering = **CO₂-removal strategy**
- + improves soil quality (pH, nutrients, buffer capacity)
-> **mitigate soil acidification, “boost” biodiversity?**
- **But:** interactions with soil organic matter and consequences for ecosystem C-fluxes remain poorly understood
- **And:** variable effects on soil chemistry, the soil microbiome and vegetation in habitats of conservation concern



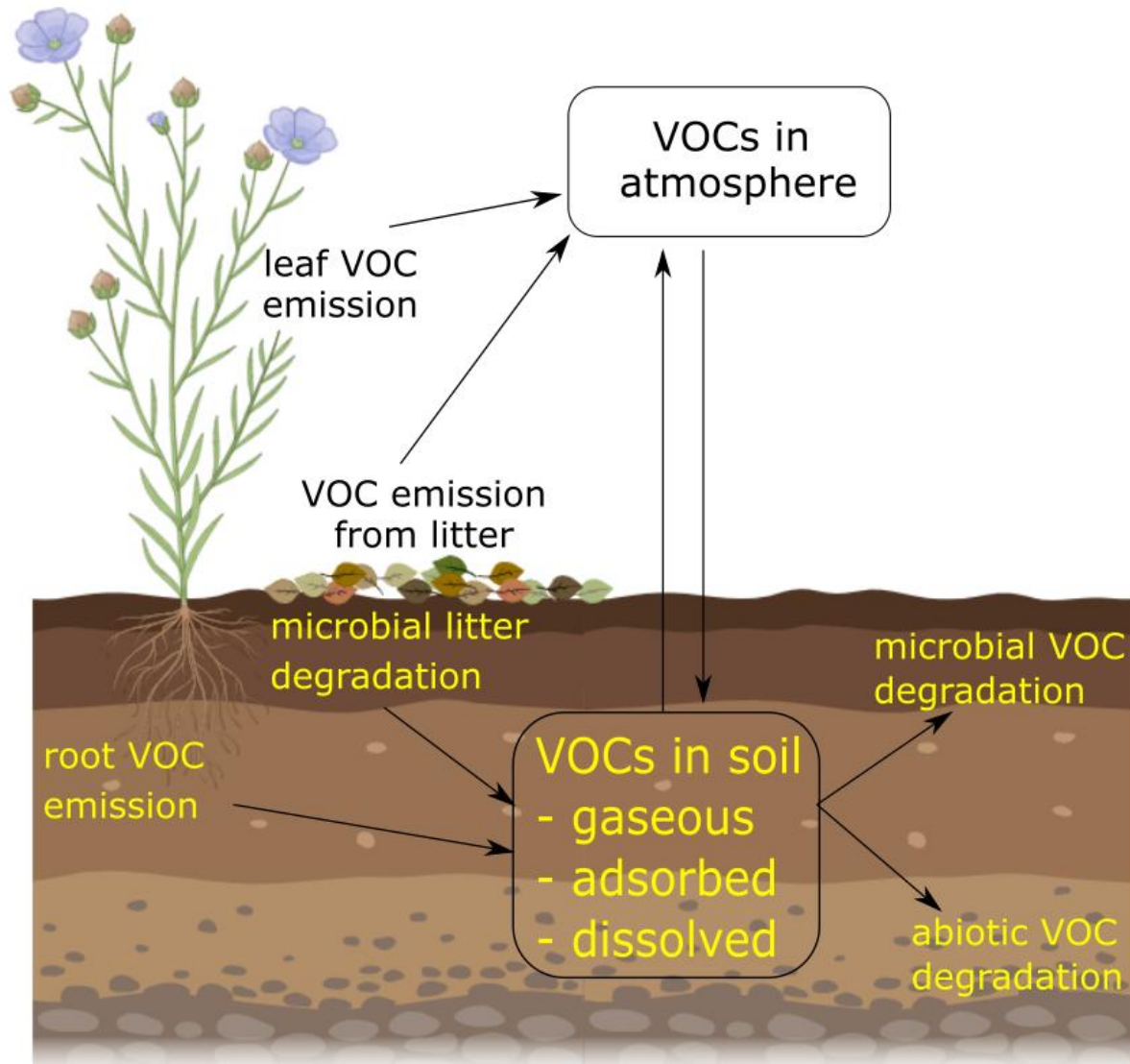
There's always room
for your own ideas! –
come talk to me ☺

EXPERIMENT

- Measure real-time C-fluxes (←) and assess changes in decomposition upon RD application across different habitat types with varying SOM contents
- Investigate the soil microbiome's response to RD 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” (Geel) (↑)

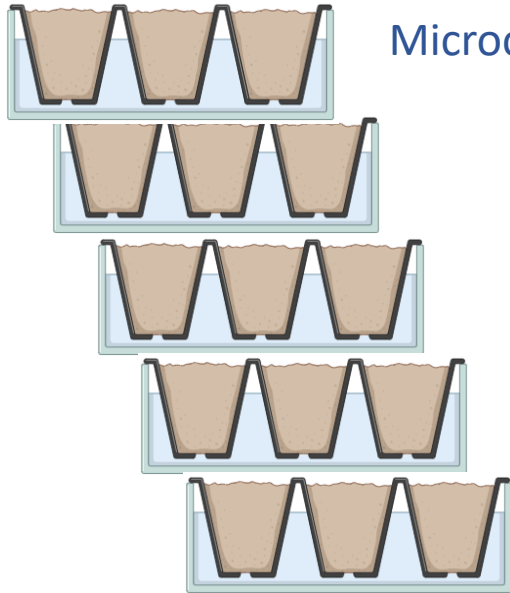
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3: The factors responsible for soil VOC emissions: influence on the composition and quantity of volatilome components



- 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
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- 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.



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Which techniques can you learn?

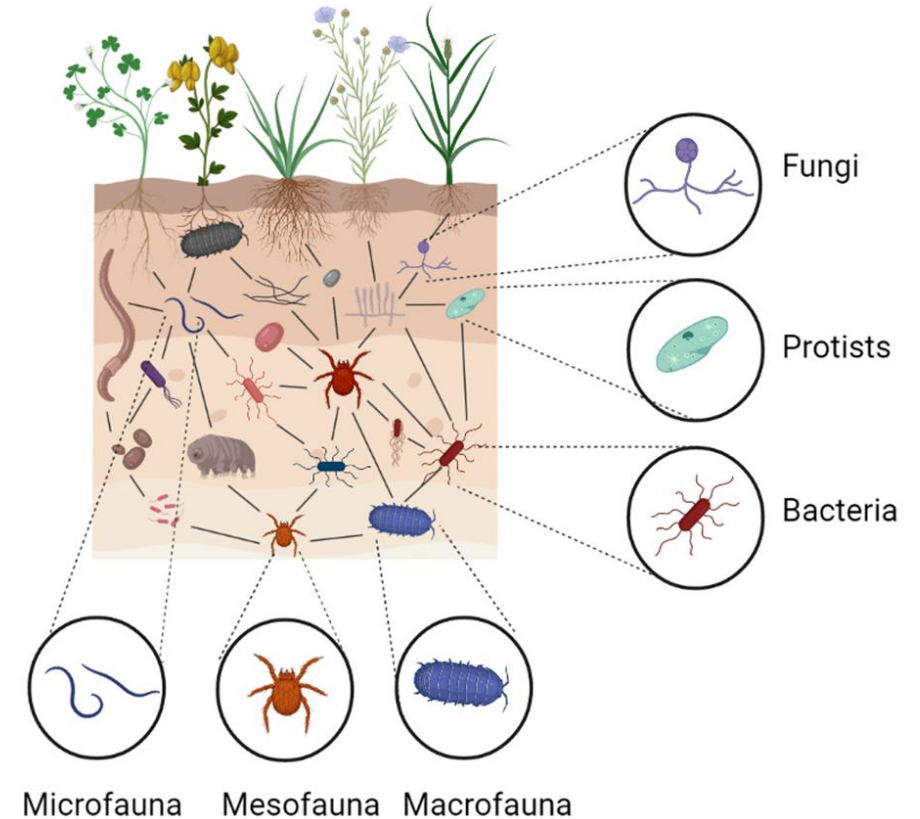
- Literature research
- Designing the experiment
- Setting up the experiment
- PTR-TOF-MS (proton transfer reaction time-of-flight mass spectrometer)
- PTR-TOF-MS data analysis
- Statistics, etc...
- Soil chemical analysis, texture, pH, etc.

4: 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
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5: **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)



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)

