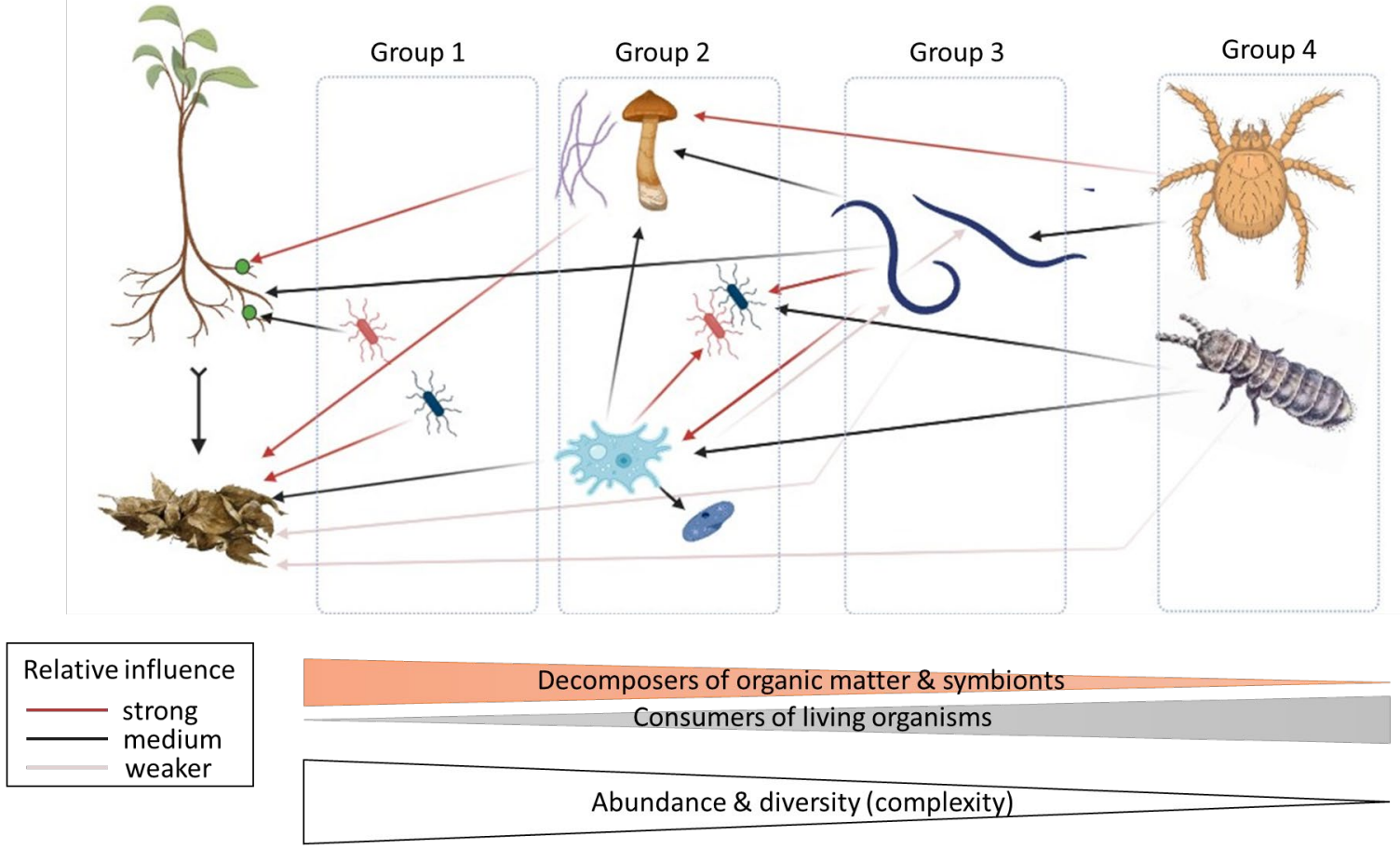
1: How the changes in the structure of soil food web influence ecosystem sensitivity to drought?



The functioning of ecosystems, including plant productivity and diversity, depend on soil organisms.

Web of interactions between soil organism profoundly affects soil functioning.

But there is sill much we don't know about the structure of food webs!

We need to study soil food webs to better understand the impact of global changes on ecosystems.

Fig. 1 Simplified structure of soil food web based on current knowledge. Groups shown here relate to the experimental setup of this project. Group 1 includes soil bacteria, Group 2. soil microbes in general (bacteria, fungi, protists), Group 3. soil microfauna (nematodes), Group 4. soil mesofauna (mites and springtails). Larger soil organisms are not considered here.

How the changes in the structure of soil food web influence ecosystem sensitivity to drought?

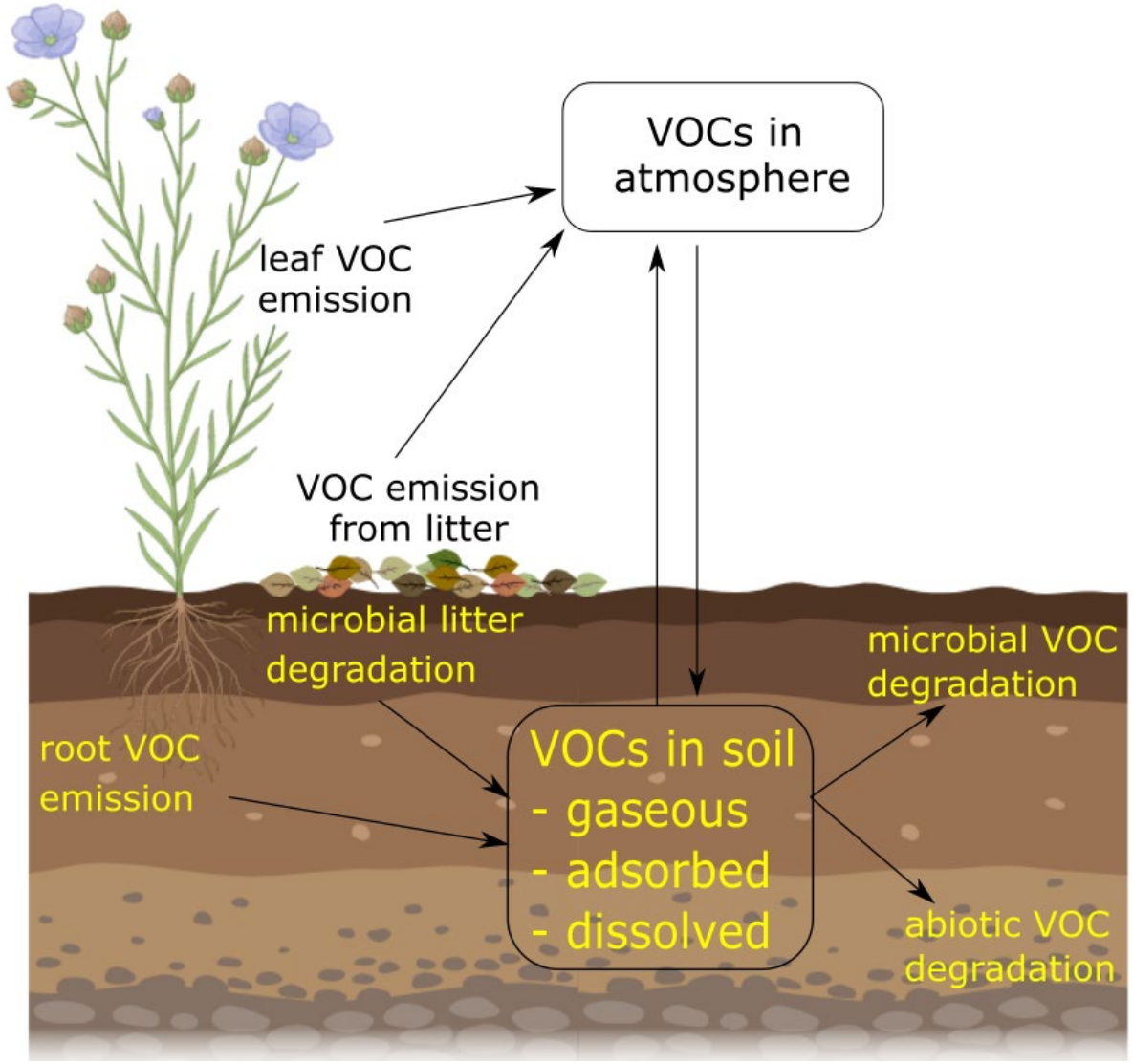
- In this microcosm experiment, the soil food web structure will be manipulated by changing the diversity and abundance of four major groups of soil organisms (Fig.1). Grassland plants will be grown in each microcosm; part of the microcosms will be exposed to drought.
- At the end of the experiment, the effect of soil treatments and drought on plant productivity will be assessed. Soil community will be sequenced using next gen sequencing.

- The student will have a chance to learn how to design, set up and perform an experiment working both with soil and plants; how to analyze soil communities using molecular analyses (DNA extraction, PCR, electrophoresis); how to analyze sequencing data and perform various statical analyses on community data.
- Depending on the interest, the student can also focus on other techniques such as: analyses of soil properties, analysis of volatile organic compounds emitted from soil, soil enzyme activities, microbial respiration etc.

For more info contact dr. Dajana Radujkovic
dajana.radujkovic@uantwerpen.be

Fig. 2 Overview of the main steps of the project: 1. experimental part, 2. molecular analyses, 3. analyses of sequencing data and statistical analyses.

2: 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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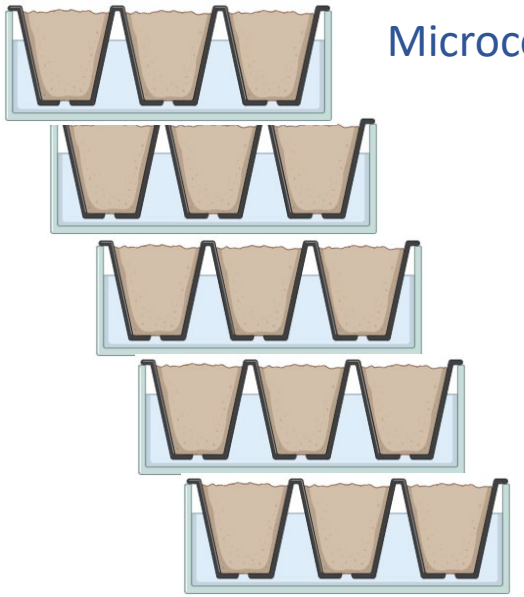
- VOC measurements from soils are challenging, unexpected results, variety of compounds… much to discover!
- High-end technique (PTR-TOF-MS)

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

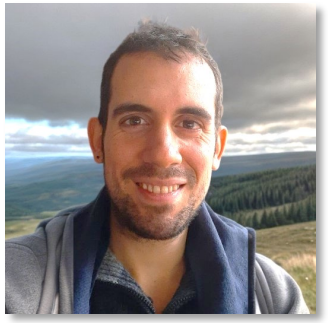


Microcosms with combinations of:

- 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
Miguel.PortilloEstrada@uantwerpen.be

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.

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

Contact: Erik Verbruggen: Erik.Verbruggen@uantwerpen.be & Willem-Jan Emsens: Willem-jan.emsens@uantwerpen.be

Contents of the thesis

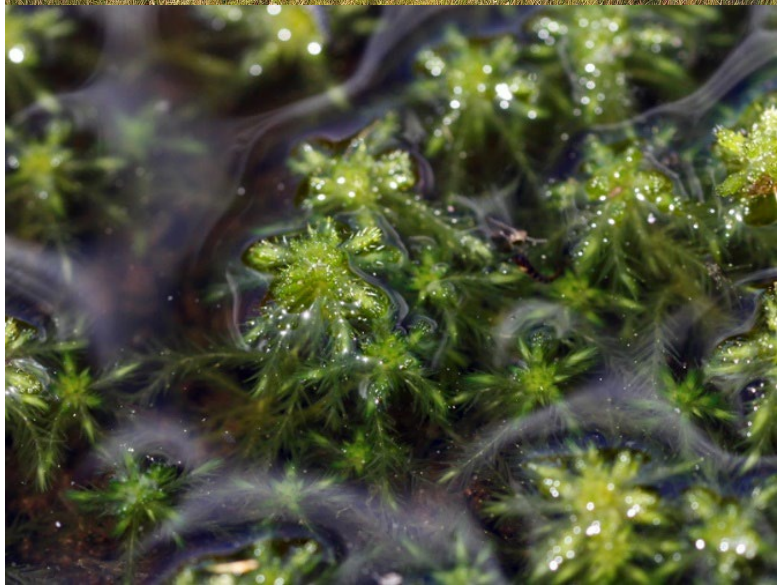
- Investigate soil microbial community composition across different N2000 habitat types (DNA)
- Link microbial community data to vegetation community data
- Can we predict habitat type using microbial data?
- Option to conduct field work in “no-access” nature reserve De Zegge (Geel)
- Option of data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

4 Peat moss (*Sphagnum spp*) reintroduction for peatland restoration

Contact: Tobias.Ceulemans@uantwerpen.be & Willem-Jan Emsens: Willem-jan.emsens@uantwerpen.be

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)



5: Other topics are also possible!

- 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