

Understanding the impact of aboveground invertebrate decline on soil biodiversity and ecosystem functioning



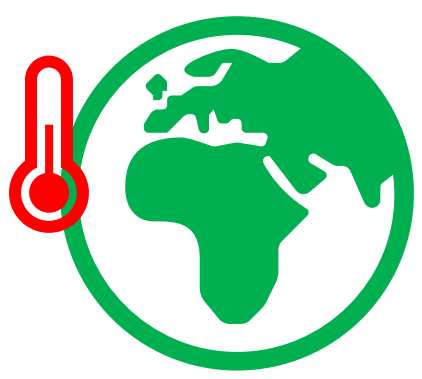
Ioannis Constantinou^{1,2}, Malte Jochum³,
Nico Eisenhauer^{1,2}

experimental
interaction
ecology



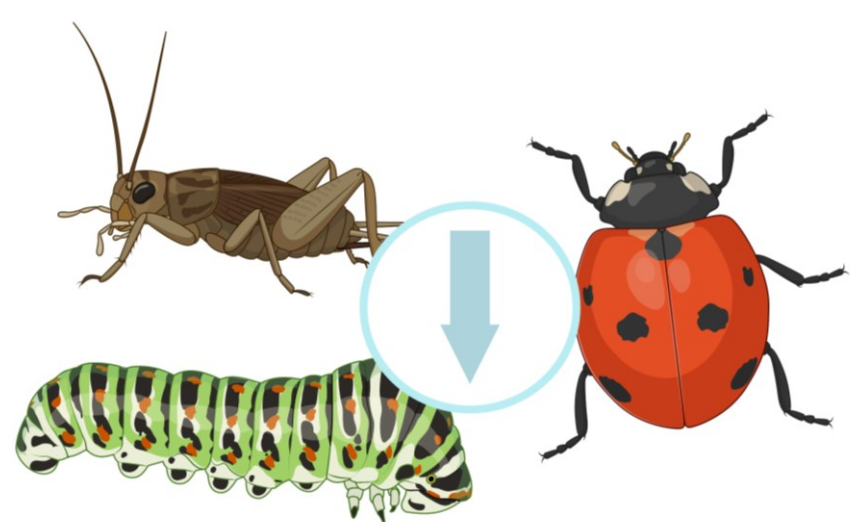
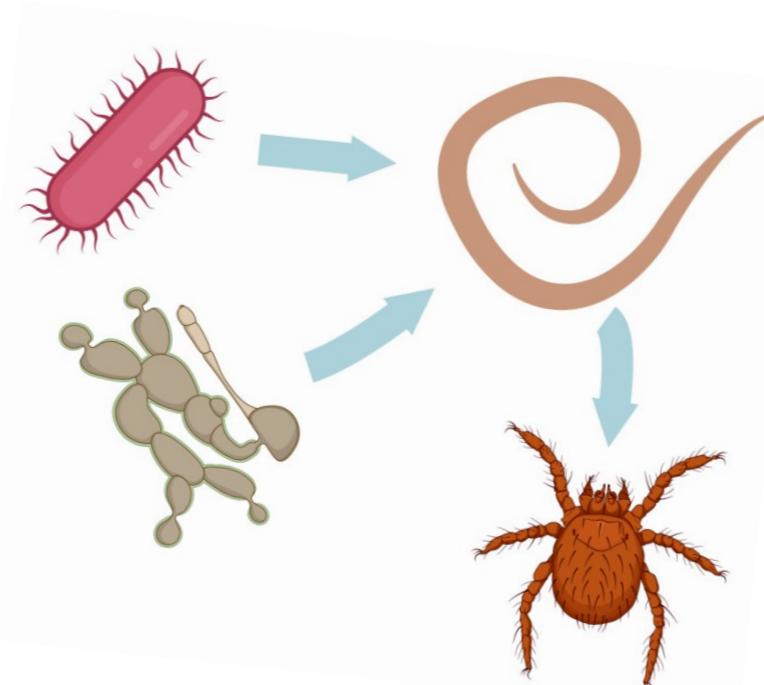
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Thesis outline



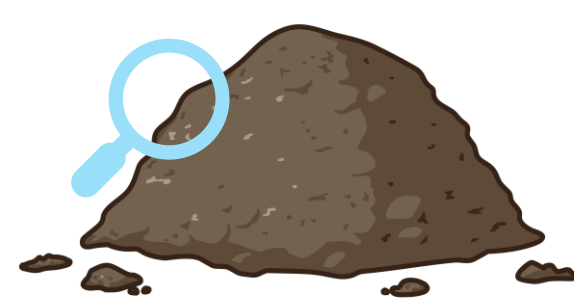
Global change is reshaping above- and belowground communities, with significant effects on **ecosystem processes**.

These impacts rely on **interactions** across taxa, and especially through **trophic interactions**.



Declines in **aboveground invertebrates** disrupt nutrient and **energy flow** to the belowground organism communities, affecting soil biodiversity and ecosystem functioning.

My thesis investigates these **cascading effects** of invertebrate decline on **soil biota** and **ecosystem functioning**.



2

Methods and Experimental Design

Data from three experimental platforms: **Insect Armageddon** (2018, Fig. 1-a and 2), **BadBug/BugNet** (2022-, Fig. 1-b and 3) and **FunDrought** (2023, Fig. 1-c and 4) will be utilized.

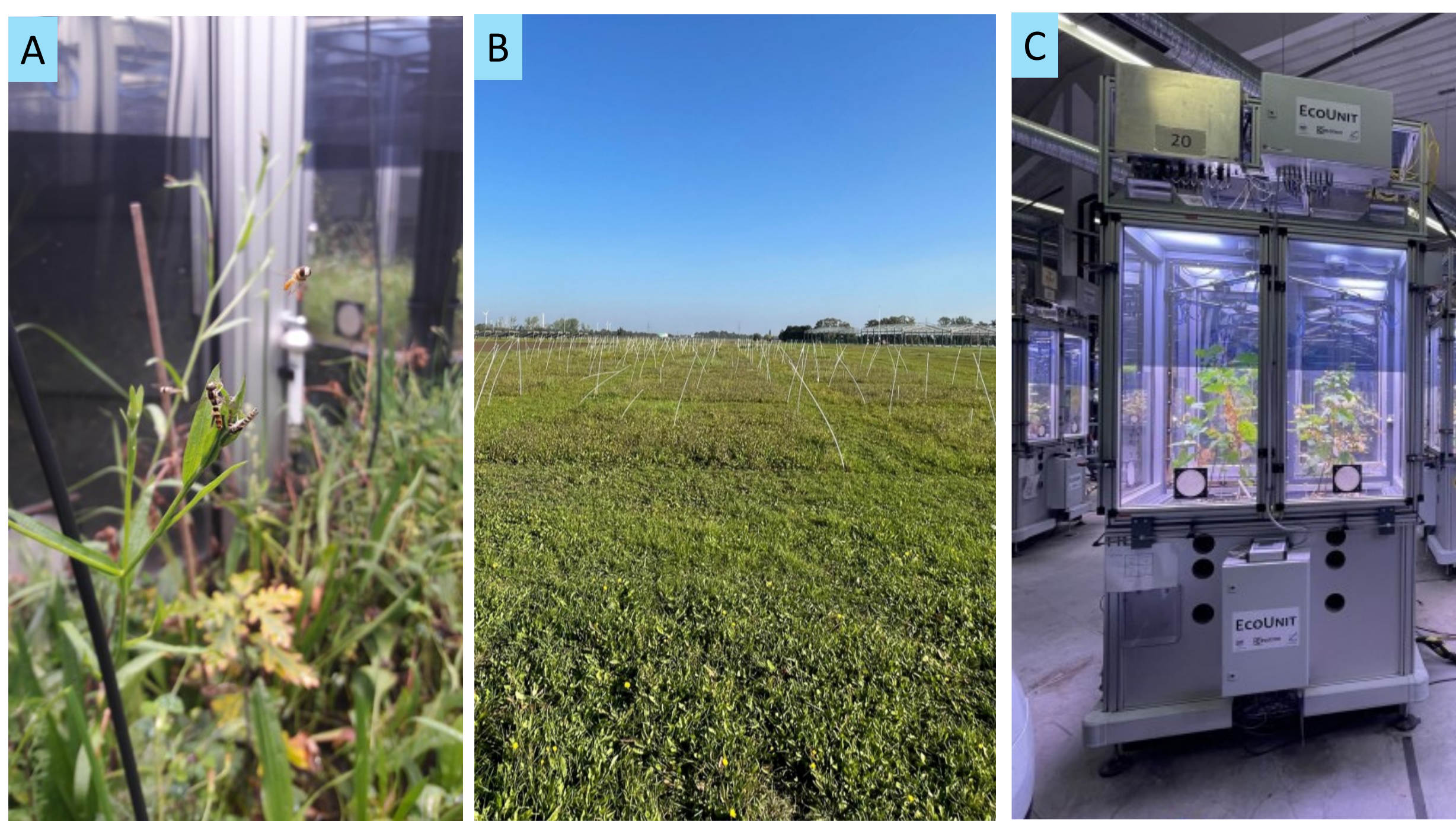


Figure 1 - (A) Close-up from one of Insect Armageddon's EcoUnits, (B) Our experimental site of BadBug, (C) One of FunDrought's EcoUnits.

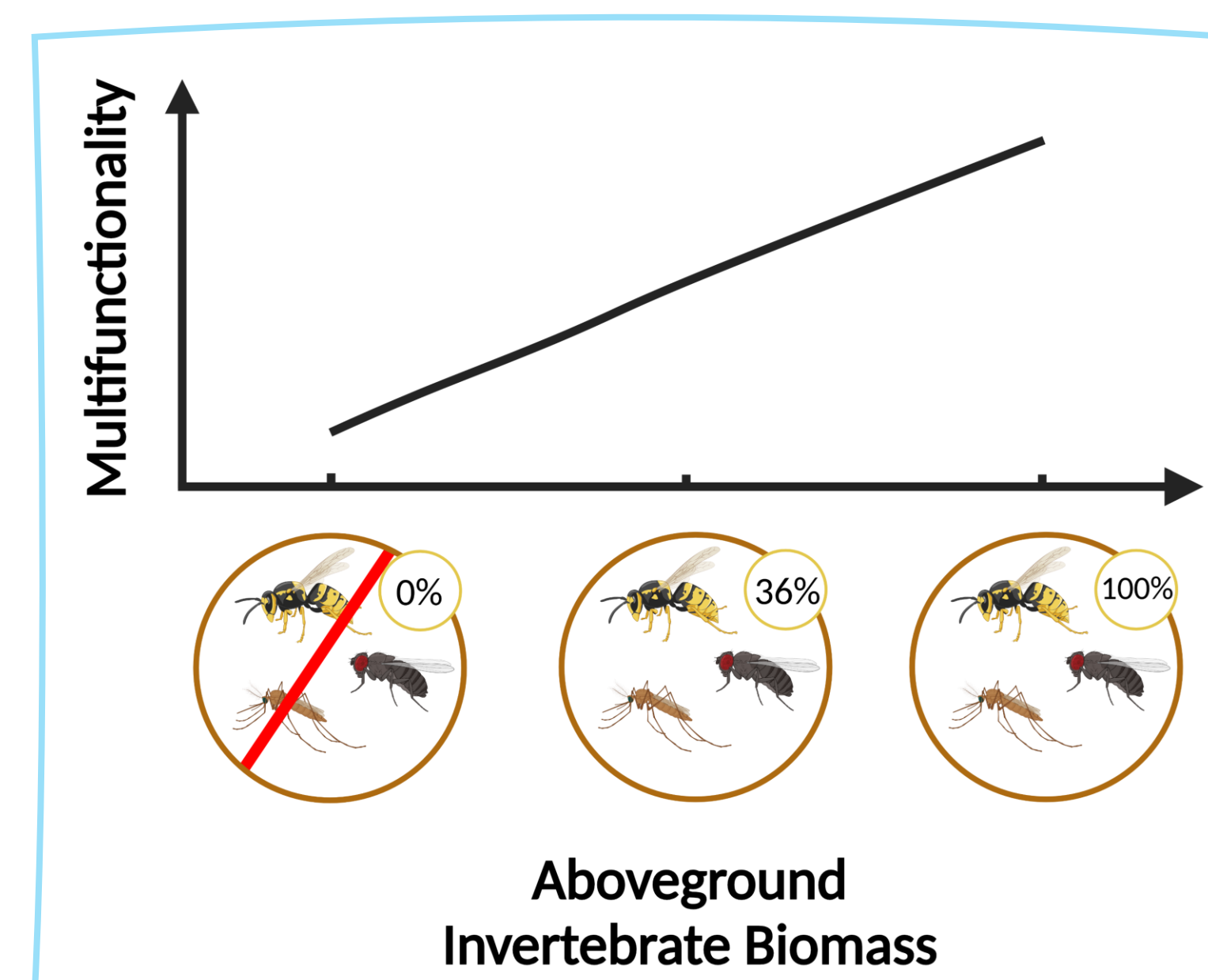
In the scope of this thesis, we will:

- Construct **soil food webs**
- Quantify **energy fluxes** across trophic nodes
- Estimate **ecosystem functions** (decomposition, herbivory, and pest control)
- Compare estimates **across treatments**
- Analyze how aboveground **invertebrate decline** impacts **soil ecosystem functioning**

3

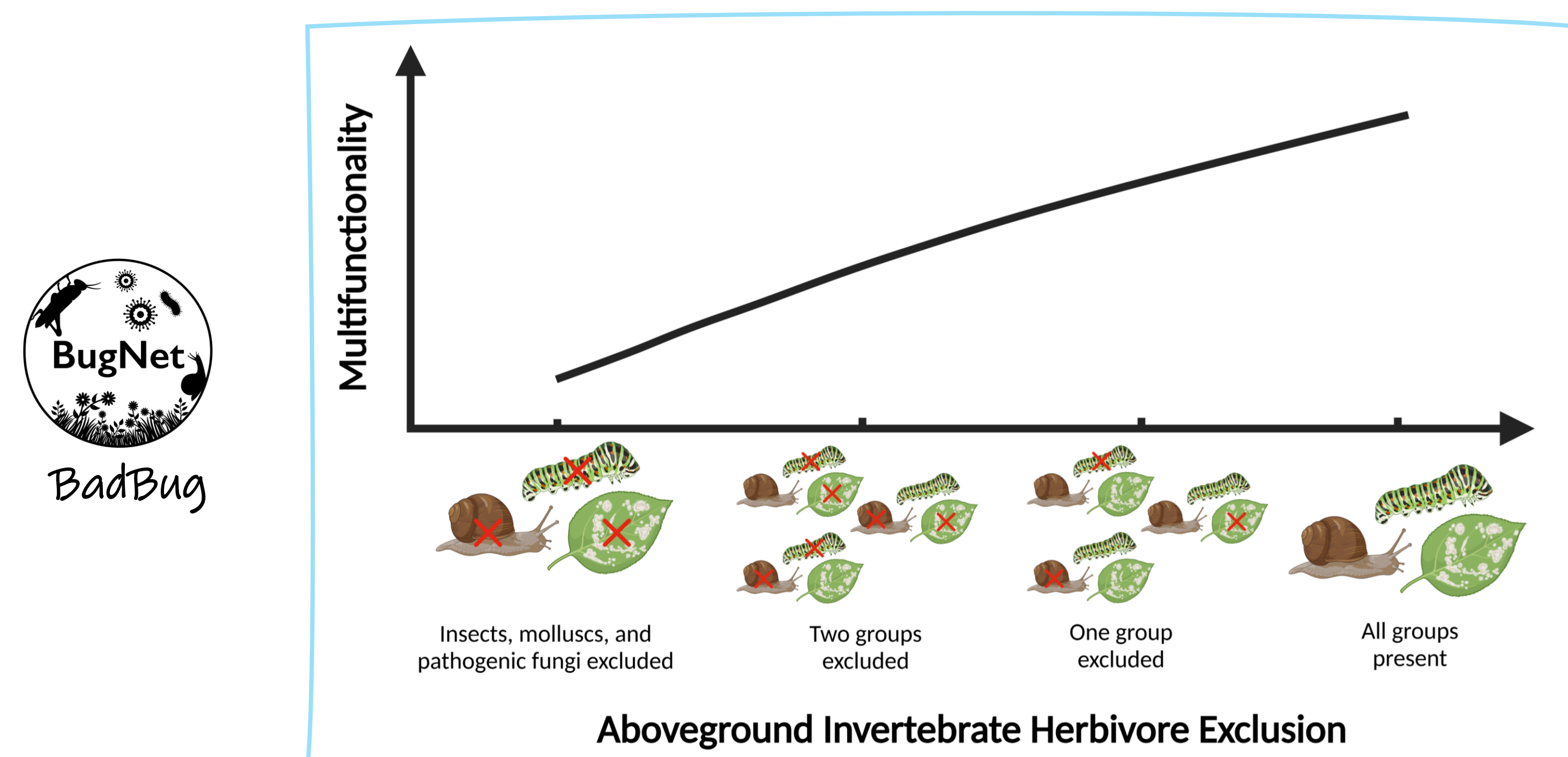
Visualizing our hypotheses

Our hypotheses build on the essential links between **multidiversity**, **multifunctionality**, and the interactions between the above- and belowground ecosystem compartments (Figures 2, 3, and 4).



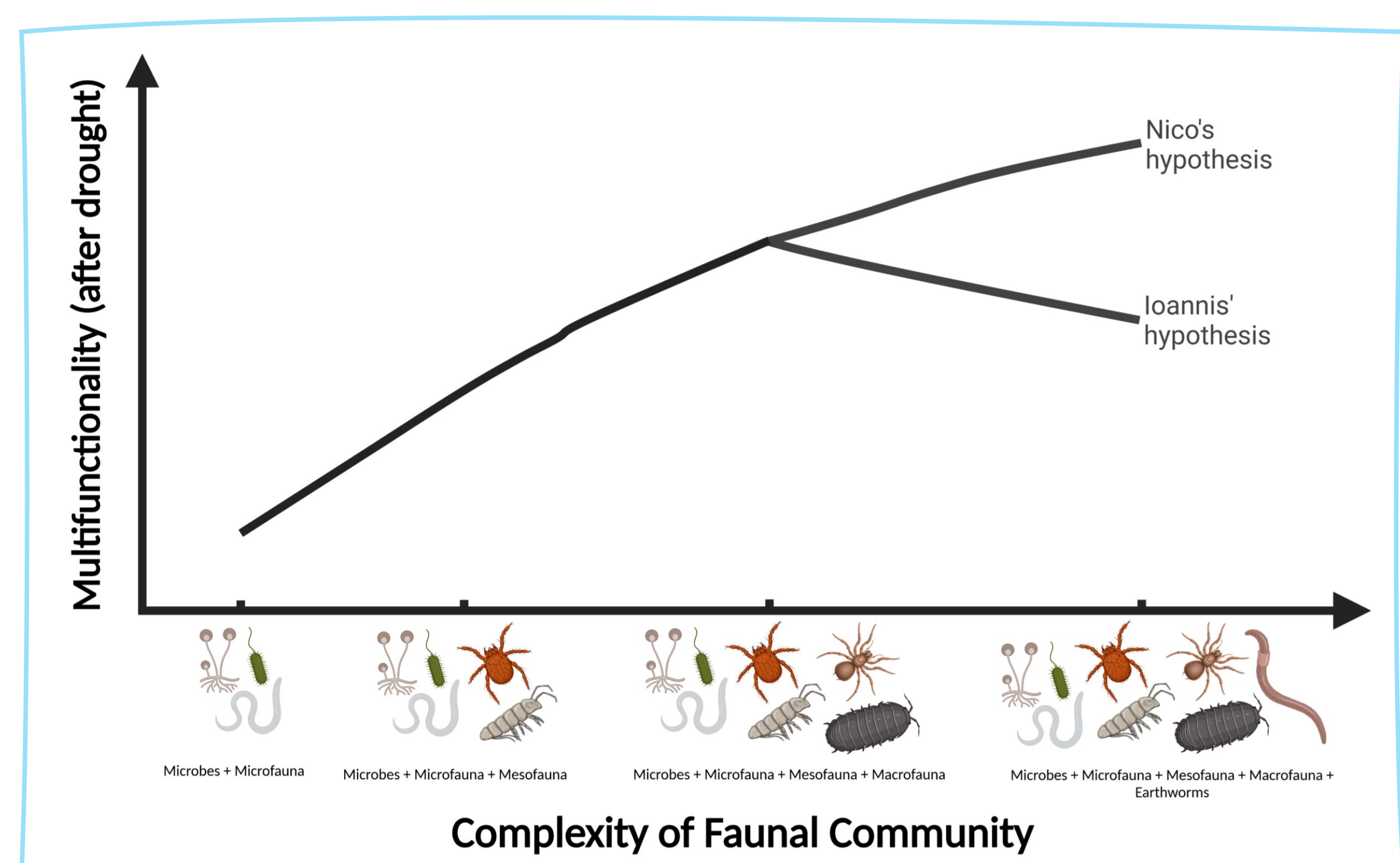
Ecotron
Insect Armageddon

Figure 2 - Aboveground invertebrate biomass decline will **decrease soil functioning**, through **altered inputs** to the soil communities.



BugNet
BadBug

Figure 3 - Excluding aboveground herbivores boosts plant performance and **changes inputs** to soil systems.



Ecotron
FunDrought

Figure 4 - Soil fauna complexity **drives functioning**, particularly after **drought**.

4

Outlook and Significance

This research will highlight the critical role of **soil biodiversity** in driving key **ecosystem functions**, such as plant productivity and decomposition.

Yet, little is known about how **global change**, particularly **invertebrate decline**, impacts these critical **belowground functions**.

Our Collaborators:

BugNet: Anne Kempel, Eric Allan, Lotte Korell, Martin Schädler and Harald Auge

FunDrought: Pierre Ganault, Jes Hines and Alban Gebler

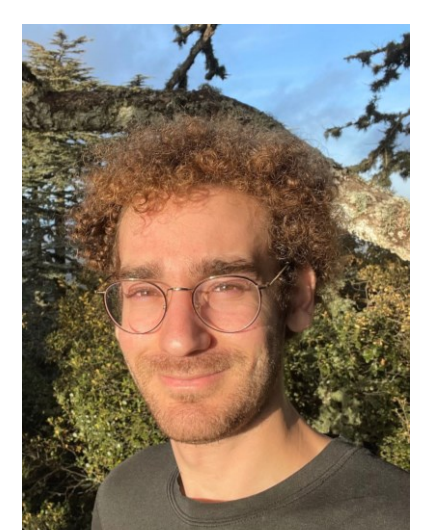
Other Collaborators: Krassimira Ilieva-Makulec and Marcel Ciobanu

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