A method for up-scaling the assessed soil ecological functional state with the use of UAS data

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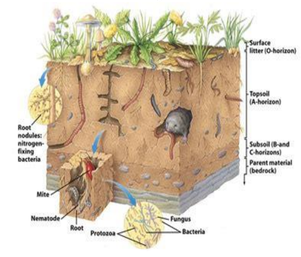
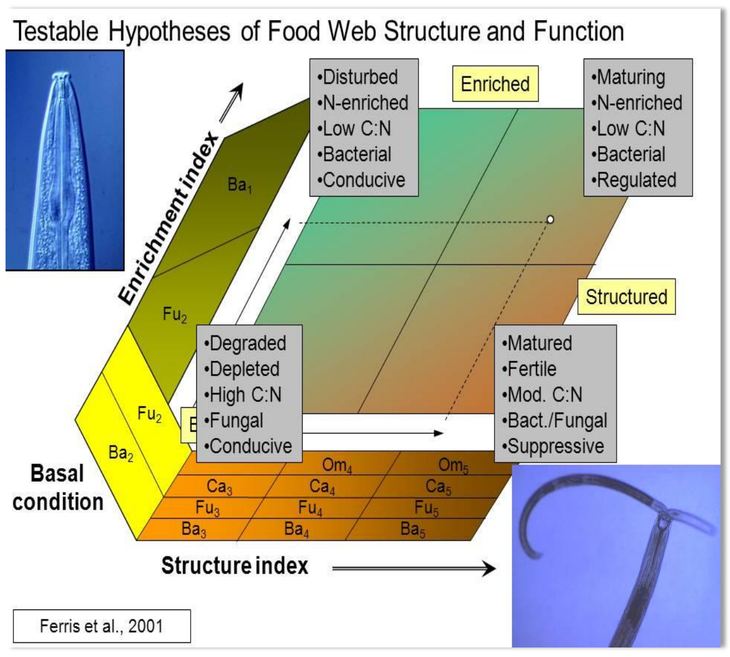
Soil ecosystem



Introduction & Concept:

❑ **Soils** deliver ecosystem services that enable life on earth and **soil organisms** are pivotal in maintaining soil functionality that generate these ecosystem services.

❑ Among soil organisms, **nematodes** are good bio-indicators & assessment of their community provides insights about soil ecological functioning



❑ Their assessment though is performed usually at a small (sample) scale.

❑ To be effective in monitoring procedures of conservation and management efforts we need to **upscale** the assessed soil ecological functional state from the sample to the landscape level.

Aim:

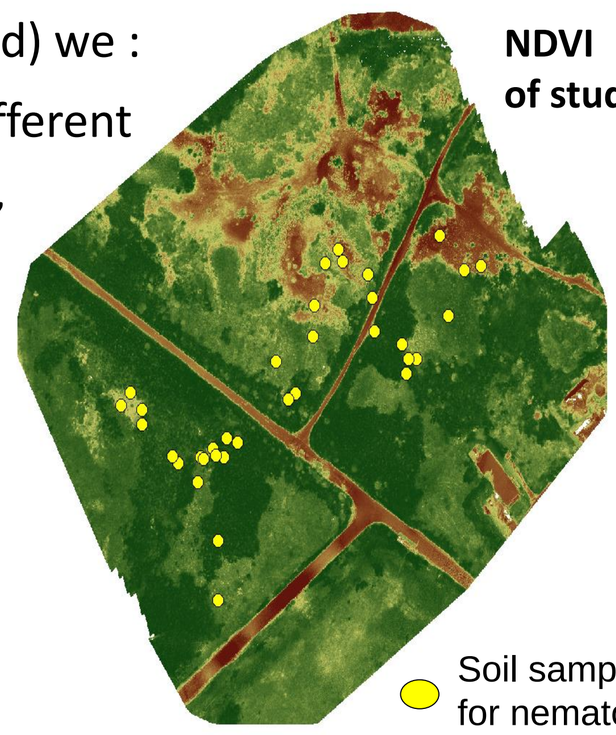
Establish a method to upscale the bio-indication potential of soil organisms from the sample to the landscape level and create maps of the ecological functional state.

Methodology:

In a heath-land in Reykjavík (Iceland) we :

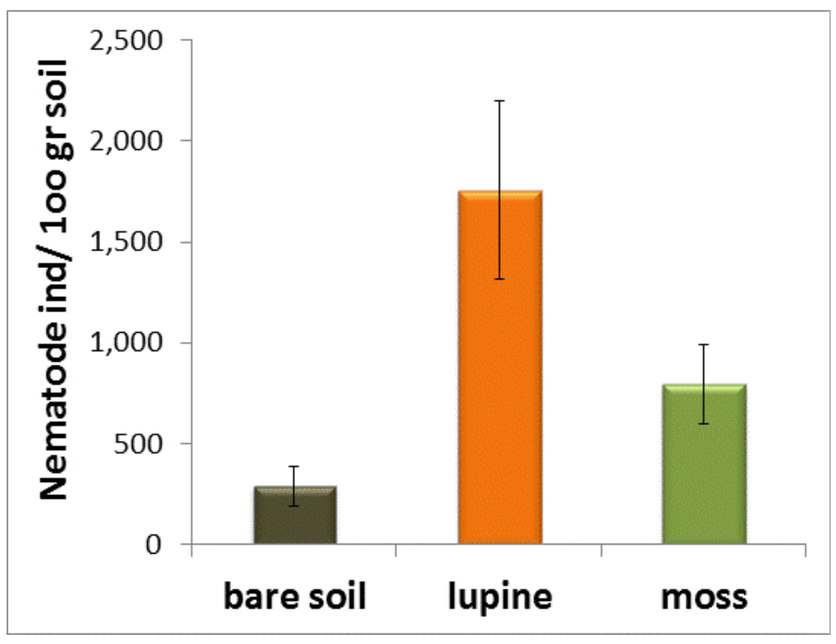
(a) took soil samples from three different microhabitats (bare soil, lupine, and moss) for the analysis of nematode communities in terms of abundance, trophic and taxonomic diversity

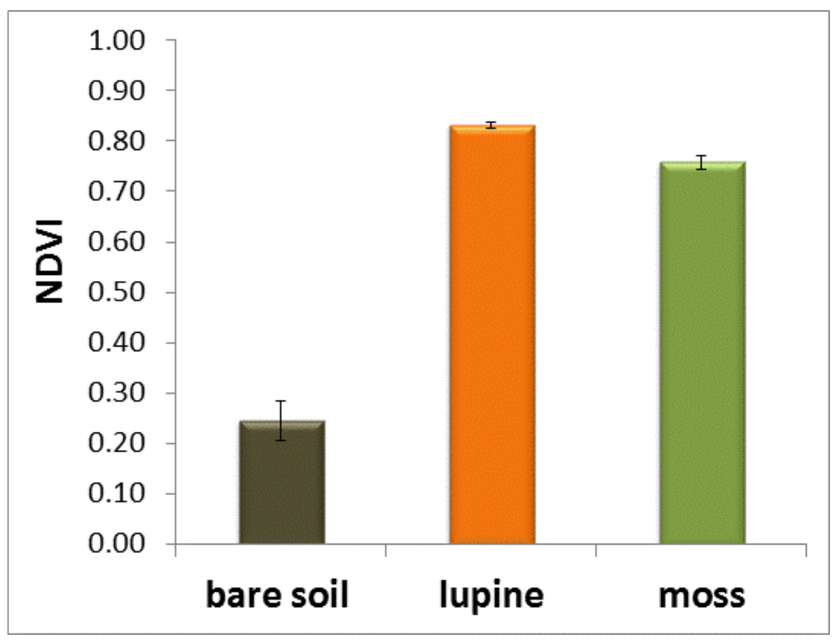
(a) we captured red, green, blue and multispectral images by a multi-rotor UAS and calculated NDVI



NDVI of study area

Results:





Similar patterns of variation were obtained for :

A) **Nematode** abundances and diversity of different functional groups

B) Values of parameters (e.g. **NDVI**) calculated from data derived by the UAS images

Mean nematode abundance and NDVI values (± st. error) in the three microhabitats of the study area

❑ **Lupine:** highest nematode abundances (and NDVI values); high contribution of bacterivorous nematodes = increased mineralization rate of nutrients, which might be not entirely absorbed by plants and leak out to the environment

❑ **Bare soil:** decreased nematode abundance (and NDVI values); few higher order nematodes = suppressed environment with a low functional state

❑ **Moss:** medium nematode abundance (relative high NDVI values); taxonomically rich nematode community = increased functional state

Overall conclusion and future steps:

❑ As indicated by analysis of nematode communities, ecological functioning differs between the three microhabitats and varies across the heathland. Our first results show that there is a relation among nematode community characteristics and data of parameters deriving from images captured by UAS/UAV.

❑ Further steps in our methodology include the construction of GLM models to describe those relations, the prediction of nematode community characteristics in non-sampled areas by interpolation methods and the construction of maps of the ecological functional state.

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HARMONIOUS UAS for environmental monitoring