

Bacteria and fungi respond to soil treatments in vineyards

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Introduction

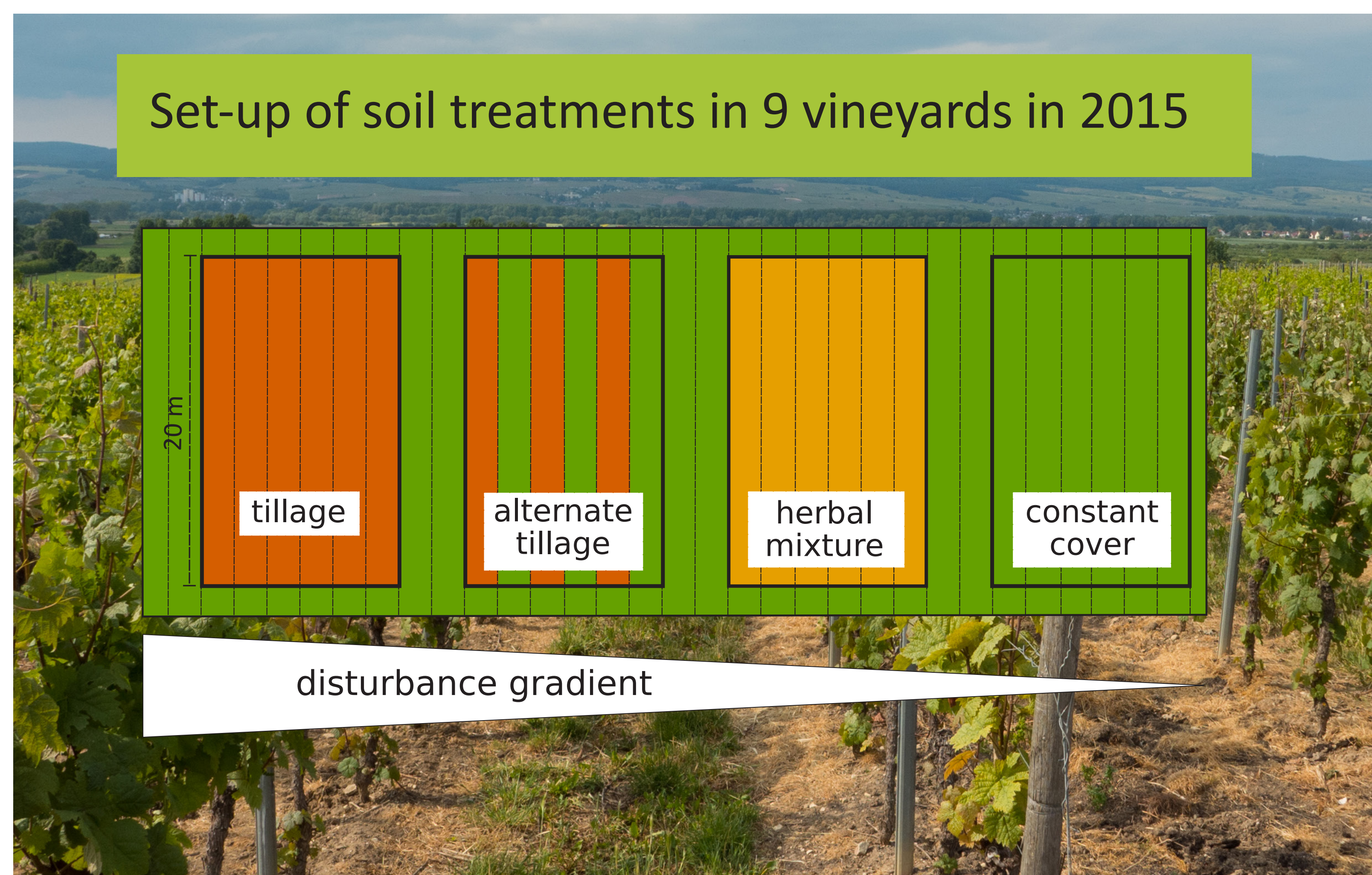
Bacteria and fungi are important soil agents mediating ecosystem processes. In agricultural systems, bacterial and fungal communities are altered by management practice as well as soil chemical variables. However, in perennial systems like viticulture, only few studies have been performed to assess the effects of soil treatment on microbial communities using a standardized field design.

Our research focusses on the responses of bacterial and fungal communities to soil treatment combined with soil chemical variables. We conducted our study in the major German wine-growing region Rheinhesse.

Main Findings

- Changes of bacterial and fungal community compositions partly reflect soil disturbance gradient.
- Influence of soil variables on microbial communities is independent from the disturbance effect.

Methods



Soil Sampling and Analysis in 2016

9 vineyards x 4 treatments x 2 inter-rows = 72 samples

soil metagenomics

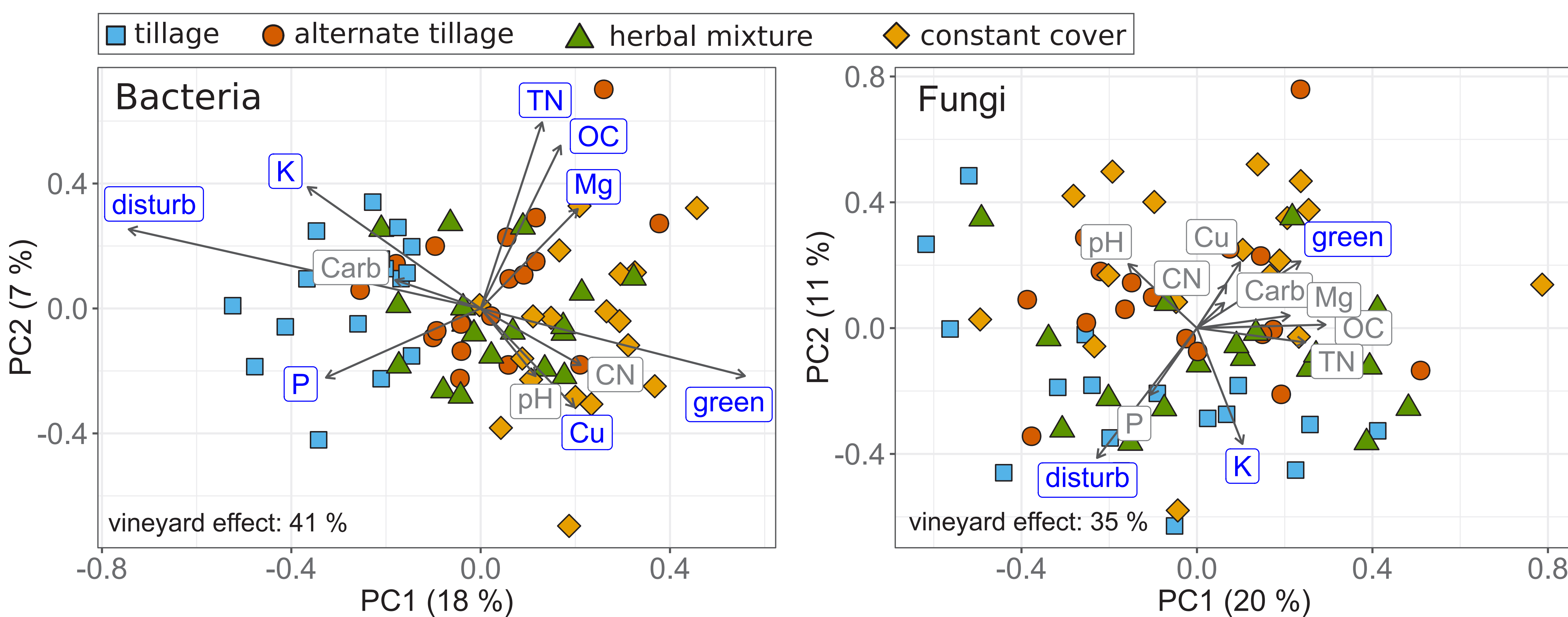
DNA extraction and next generation sequencing using molecular markers:

- bacterial 16S rDNA V4
- fungal ITS 2

soil chemical variables

- pH
- phosphor (P)
- potassium (K)
- magnesium (Mg)
- copper (Cu)
- carbonate (Carb)
- organic carbon (OC)
- total nitrogen (TN)
- C:N ratio (CN)

Results



Partial principal component analysis (pPCA) based on operational taxonomic units of bacteria (left) and fungi (right). Effect of the vineyard was considered as conditioning factor. Symbol color and shape indicate soil treatment. Vector fitting of environmental variables (soil chemical variables, disturbance gradient, green cover) was conducted on pPCA results, Blue labels indicate significant vectors (P-value < 0.05).

Interpretation of ordination results:

- Bacterial communities of tillage and constant cover treatments are separated along with the 1st ordination axis reflecting the extremes of the disturbance gradient. Influences of soil TN, OC, and Mg correlate with the 2nd axis independently from treatment.
- Fungal communities of tillage and constant cover treatments are separated coarsely along with the 2nd ordination axis with considerable overlaps. OC, TN and Mg correlate with the 1st axis, but are not significant.



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