



Soil fungal responses to global change

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Global change and soil fungi





Global change and soil fungi

Warming Nutrient enrichment Drought Elevated atmospheric carbon dioxide

> Rillig et al. 1999 *Nature* Rillig et al. 2002 *Oikos* Klironomos et al. 2005 *Nature* Camenzind et al. 2014 *Global Change Biology* Berdugo et al. 2020 *Science*



Global change: multiple factors



Bernhardt et al. 2017



Global change and soil fungi

Warming Nutrient enrichment Drought Elevated atmospheric carbon dioxide Various synthetic organic chemicals

Microplastic in soil

Rillig 2012 Env Sci Techn Rillig et al. 2017 Scientific Rep Rillig et al. 2017 Front Plant Sci Rillig 2018 Env Sci Techn Machado et al. 2018, 2019 Env Sci Techn Lehmann et al. 2019 Soil Syst Rillig et al. 2019 New Phytol Rillig et al. 2019 Env Sci Techn Liang et al. 2019 Front Microbiol

Picture by: Dr. Anika Lehmann





Global change and soil fungi

Warming Nutrient enrichment Drought Elevated atmospheric carbon dioxide Various synthetic organic chemicals Microplastic



Global change and soil fungi

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Salinity Heavy metal contamination

A lot of factors, acting concurrently!



How well are we doing with multiple factors?



Rillig et al. 2019 Science



98.2% of papers describing experiments included only 1 or 2 factors



Experimental approach









Soil fungal community responses





Could multi-factor effects be predictable?



Number of environmental drivers



Increasing number of factors





Soil fungal responses to multiple factors





Soil fungal response to multiple factors





Fungal community responses



Titel, Datum





Basidiomycota losses



Ecosystem properties and functions





Surprise: soil water repellency





Similar effects for other soil parameters...





What does it all mean?

We know little about soil fungal responses when many factors act concurrently

→Think more about concurrent action of many factors, as there may be surprises and higher order interations





What does it all mean?

We observed progressive reduction in process rates and fungal diversity with factor number

- → Reduce the number of factors acting on our soils; every measure probably helps
- → Are there thresholds/ tipping points?





DRYLAND ECOLOGY

Global ecosystem thresholds driven by aridity

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Take-home message

Many factors act on fungi, soils and ecosystems

- The *number* of factors may give a meaningful indication of trajectories of effects
- Prediction gets more uncertain with increasing number of factors involved





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Jobs: microplastic effects/ fungi

Postdoc

4+3 years (BMBF funded), crop plants and agricultural soils

Doctoral student

3 years (DFG funded), grassland plots throughout Germany



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