

Generic bio-inventory of functional soil microbial diversity in permanent grassland ecosystems across management and climate gradients

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BiodivERsA COFUND Call (2015-2016)

« Understanding and managing biodiversity dynamics to improve ecosystem functioning and delivery of ecosystem services in a global change context: the cases of soils and sediments, and land- river and sea-scapes »

CONSORTIUM DESCRIPTION

Partner 1 (coordinator): Frank Rasche, University of Hohenheim, Germany. Funded by the German Research Foundation. Team includes Post Docs Mary Musyoki and Judith Zimmermann.

Partner 2 (PI): Andreas Lüscher, Agroscope, Switzerland. Funded by the Swiss National Science Foundation. Team includes researcher Franco Widmer and Post Doc Aaron Fox.

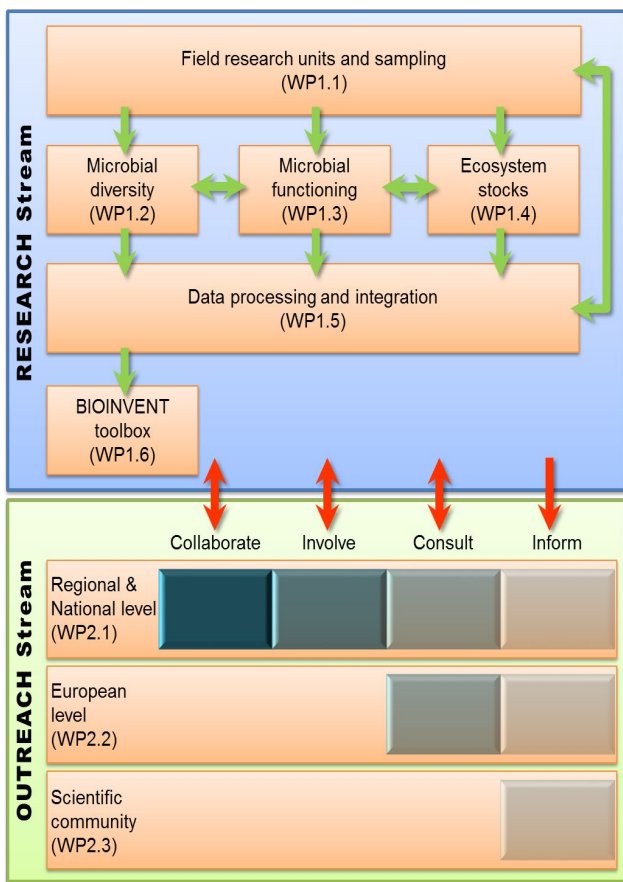
Partner 3 (PI):Luís Silva, University of the Azores, Portugal. Funded by Fundo Regional para a Ciência e Tecnologia. Team includes PhD student Angela Vieira.

Partner 4 (PI): Linda-Maria Dimitrova Mårtensson, Swedish University of Agricultural Sciences, Sweden. Funded by FORMAS, The Swedish Research Council for Sustainable Development. Team includes Post Doc Ana Barreiro.

Partner 5 (PI): Cristina Cruz, University of Lisbon, Portugal. Funding body not known.
Sub-contracted partner: Sabine Weizenegger, Akteure und Regionen, Germany.

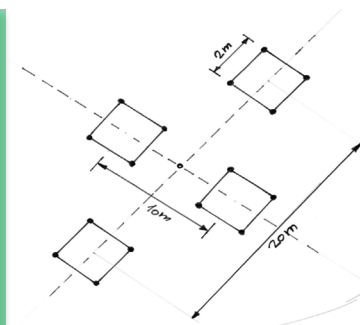
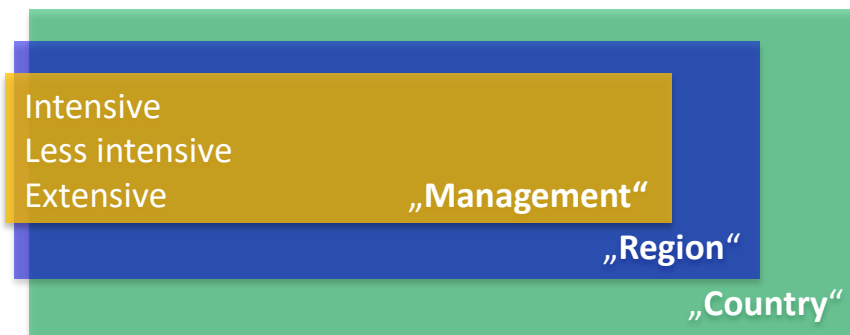
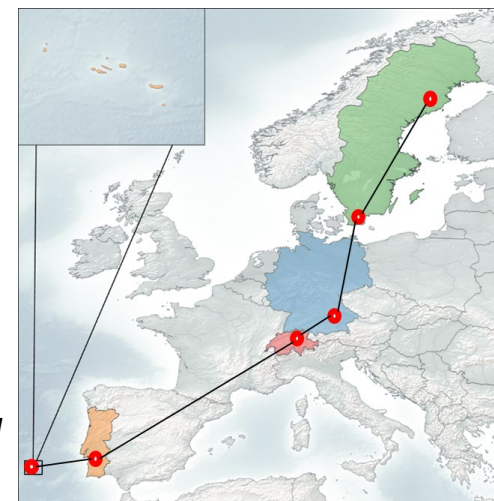


PROJECT DESCRIPTION



RESEARCH QUESTIONS

- *Is grassland management a stronger regulator of soil microbial diversity than agro-ecological distinctions across Europe?*
- *Does PEGS select for those microbial groups showing a stronger functional adaptation to below-ground resource limitation than more intensively managed grassland systems?*



SCIENTIFIC OUTPUTS

NGS sequencing (CH)

Bacteria

Country***

Region***

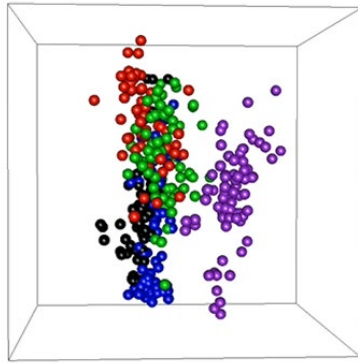
Management ***

Fungi

Country***

Region***

Management ***

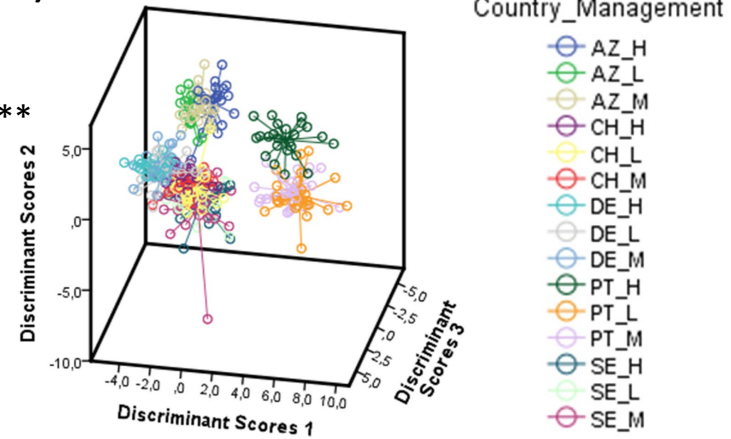


PLFA analysis (SE)

Country***

Region***

Management***



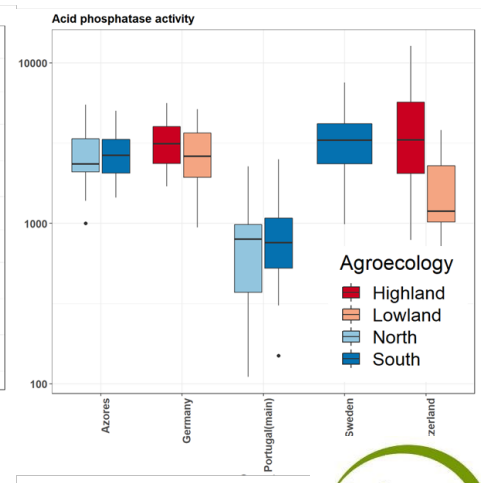
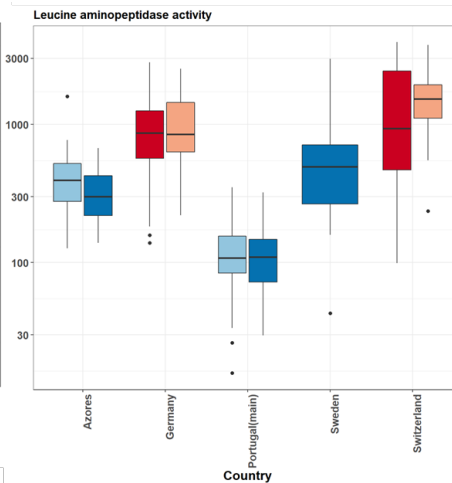
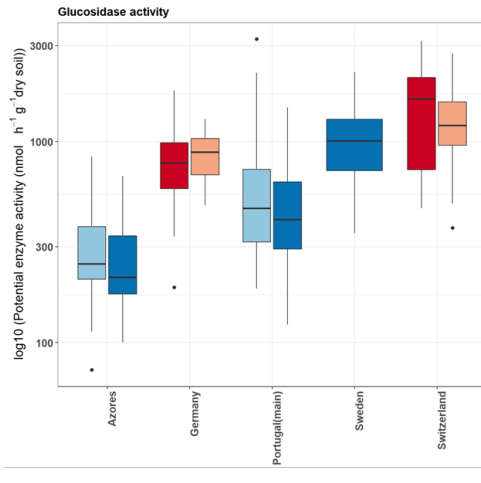
Enzyme activities (DE)

LAP, BGL, and APH

Country***

Region***

Management^{NS}



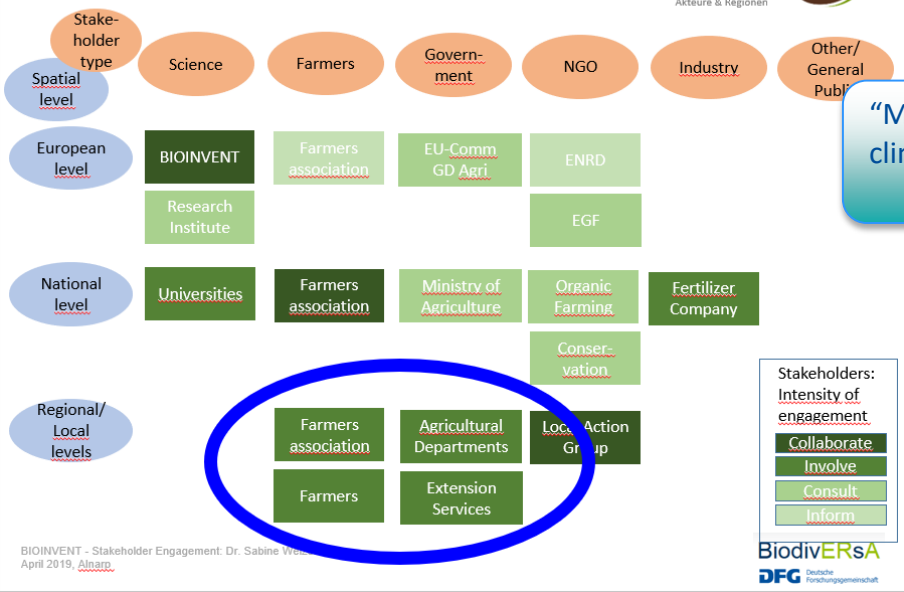
SCIENTIFIC OUTPUTS



- *At the European scale, the agro-ecological distinctions is the stronger regulator of soil microbial diversity and biomass (compared to the management factor).*
- *At the national or regional scale, grassland management is a strong regulator of soil microbial diversity and biomass.*
- *PEGS do select for fungal microbial organisms (mycorrhizal and saprotrophic fungi), which could be an indicator for a functional adaptation to below-ground resource limitation (than in more intensively managed grassland systems).*
- *Knowledge to be used in model systems for dual-use, multifunctional perennial cereal production.*

SOCIETAL / POLICY OUTPUTS

Stakeholders in BIOINVENT

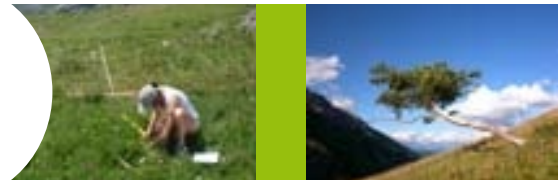


“Management for uncertain climate conditions.”
Farmer from Portugal

“From the project I expect information to better manage my pastures.”
Farmer from Portugal

“Many farmers were worried that the data gained by our project will be used “against” them (i.e. more regulations and restrictions by politics concerning the management of grassland such as fertilizer input etc.)”
Researcher

“The economic sustainability of the farms has to be in the foreground, because the alternative would not be the ‘better farmer’ but no farmer!”
Farmer from Germany



SOCIETAL / POLICY OUTPUTS

Stakeholder workshop in SE: “If we want to improve soil quality...”

1. Why are soil microbes important in crop production?
2. Which challenges do you find between different interests in soil management?
3. How can we find synergies between the production goal and other needs?
4. What can we do together?

“Our joint efforts should focus the production of high-quality food products.”

“Shift focus from managing the crops to managing the soil.”

“The problems will force us to adopt farming practices that promote soil organic content and we will be forced to see the synergies.”

“Lacking knowledge and information due to limited communication from researchers in a popular format...”

“Different interests (economy and nature protection, short- and long-term mind-sets, owner and user goals, etc) are challenges in soil management.”

The World café method (Fouché & Light 2010; MacFarlane et al 2017)

SOCIETAL / POLICY OUTPUTS

BIOINVENT HANDBOOK

including a technical toolbox
with selected indicators



Policy Brief

The Common Agricultural Policy can strengthen biodiversity and ecosystem services by diversifying agricultural landscapes

Main findings

If managed appropriately, Europe's diverse farmland landscapes can provide many benefits to people and nature as well as more sustainable agriculture. **Ecosystem services** such as **pollination** and **natural biological pest control** depend strongly on the amount of semi-natural habitat patches on farmland, and the preservation of such habitats will become even more important due to the **effects of climate change**.

Conservation of **heterogeneous landscapes**, characterized by a high proportion of semi-natural habitats such as pastures and field margins, enhances and stabilizes pest control by natural predators and pollination by wild insects and decreases sensitivity to climate change. Increasing **habitat diversity** enhances biological pest control independently of crop diversity, indicating that it is an effective strategy for farmers.

Key policy recommendations

- Promote the use of EU Common Agricultural Policy (CAP) measures to maintain and restore semi-natural habitats and landscape elements (such as pastures, meadows, hedges, hedgerows, forest patches, ponds) and field margins in agricultural landscapes for their value for biodiversity, pollination and natural biological control of pests.
- Set policy targets for the minimum proportion of uncropped areas in arable farmland areas to maintain and increase the stability and resilience of biodiversity and ecosystem services in the face of climate change.
- Set CAP policy targets for the conservation and restoration of semi-natural farming habitats including the Natura 2000 network.
- Recognize the long-term environmental, social and economic values of mixed farming landscapes and promote the coherence of CAP measures and implementation to help maintain such systems and landscapes against the pressures of globalization.

Technical Toolbox

Agri-ecological landscapes and ecosystem services

Recommendations

and qualitative targets for heterogeneous farmlands, forest patches, ponds, particularly in landscapes with a low crop cover.

of evidence for GI's long-term services, and develop best practice. Involve farmers in the design of GI conservation and services.

practical adaptation to GI fact sheets under CAP research under the EU Erasmus+ service, consider payments and GI, which deter farmers from adopting GI conservation and services.

ion and enhancement a key CAP research initiative. CAP measures, climate payments

Recommendations

service mapping and integrated ecosystem management and their implementation on services.

assessments and participatory mapping a clear understanding of regional ecosystem management and identifying the beneficiaries of services.

of participatory ecosystem mapping with optimization tools sustainable and desirable policy instrument options.

ACKNOWLEDGEMENTS

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Forschungsgemeinschaft

FNSNF

FONDS NATIONAL SUISSE
SCHWEIZERISCHER NATIONALFONDS
FONDO NAZIONALE SVIZZERO
SWISS NATIONAL SCIENCE FOUNDATION

FORMAS 

Fundo Regional para a Ciência
e Tecnologia

 **FRCT**



SCIENCE AND
EDUCATION **FOR**
SUSTAINABLE
LIFE