

Agricultural Diversification: DIGGING DEEPER

Florian Walder (Partner 1)

Funded projects final conference, 12-13 November 2019, Brussels

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

Our consortium:

Partner 1, Switzerland: (coordinator): Anna Edlinger (PhD), Gina Garland (Postdoc), Marcel van der Heijden (PI) , Agroscope.

Partner 2, Sweden: Aurélien Saghai (Postdoc) Sara Hallin (PI), Swedish Agricultural University, Uppsala.

Partner 3, Spain: David Sánchez (Postdoc) Fernando Maestre (PI), Universidad Rey Juan Carlos, Madrid.

Partner 4, France: Sana Romdhane (Postdoc), Laurent Philippot (PI), INRA, Dijon.

Partner 5, Germany: Florine Degruene (Postdoc), Matthias Rillig (PI), Freie Universität Berlin.

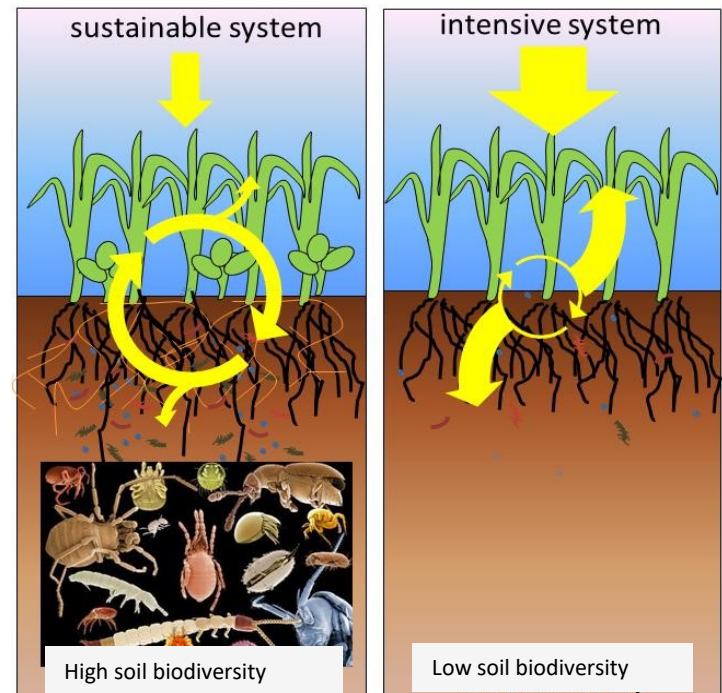
Self funded: Samiran Banerjee, Chantal Herzog & Cameron Wagg (Agroscope, Switzerland), Pablo García-Palacios (Universidad Rey Juan Carlos, Spain), Ayme Spor (INRA, France).

SCIENTIFIC OBJECTIVES

Aims / Themes:

1. Quantify the impact of diversifying land use/agricultural practices in Europe, on soil communities, ecosystem functions and services.
2. Determine the role of soil diversity for multifunctionality of European agroecosystems.
3. Assess the impacts of climate change on the provision of ecosystem services by agroecosystems from different climatic zones, management practices and soil biodiversity levels.
4. Identify innovative land management practices that maximize the delivery of multiple ecosystem services delivered by soil biota.

Central Hypothesis: Agricultural Diversification enhances Soil Biodiversity and Ecosystem Sustainability



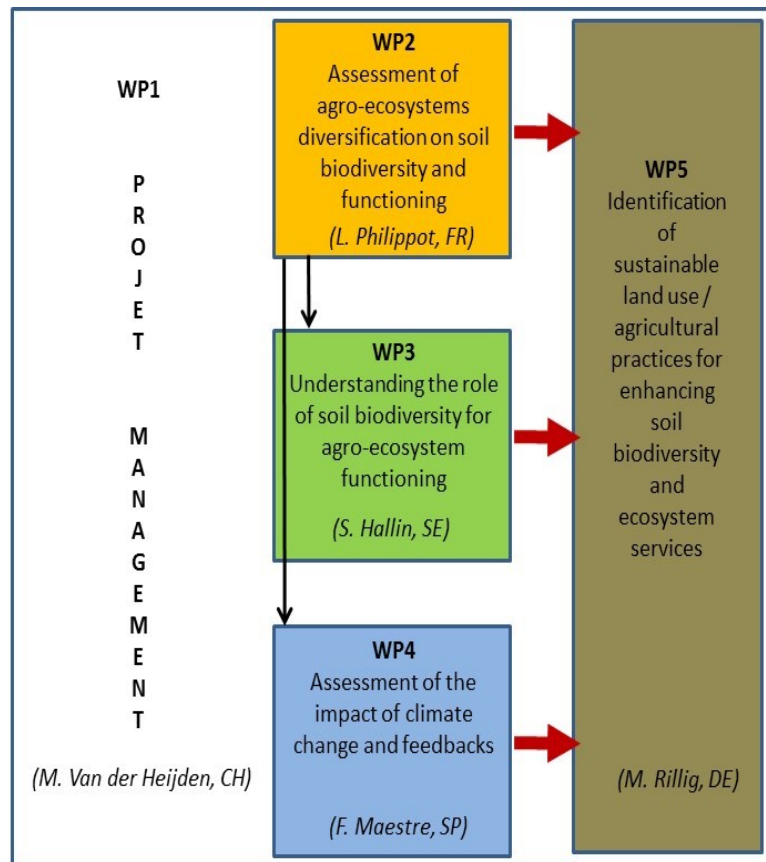
Bender et al. 2016, Trends in Ecology & Evolution 31: 440-444

Bender et al. 2017, Trends in Ecology & Evolution 32, 11-12

APPROACH

Project Organisation: Five Workpackages
(5 Postdocs & 1 PhD student)

Our Approach: Mapping soil biodiversity and soil
ecosystem services across a European gradient
(155 sites with wheat; 62 sites with grassland)





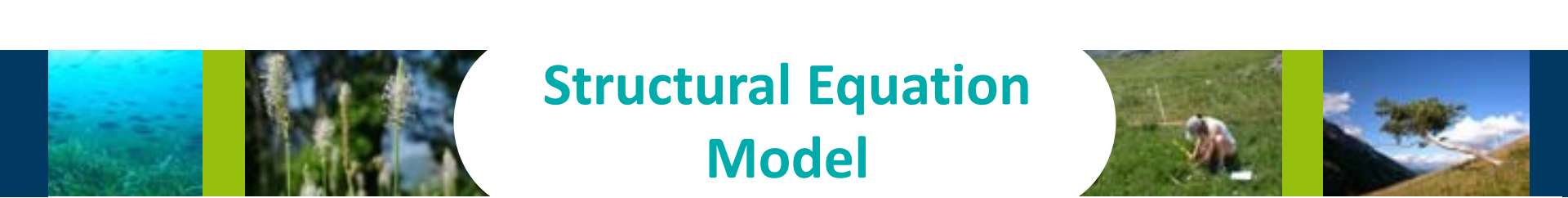
Aggregate stability and soil carbon

This graph shows the effect of country, land use type and agricultural diversification on soil aggregate stability (unpublished results – please contact the coordinator for further information).



Yield and soil multifunctionality

This graph shows the relationship between crop diversity and crop cover with soil multifunctionality and crop yield (unpublished results – please contact the coordinator for further information).



Structural Equation Model

This structural equation model shows the factors explaining yield and soil multifunctionality (unpublished results – please contact the coordinator for further information).

Cover crop experiment

Impact of cover crop management practices on the diversity, composition and functioning of soil bacterial communities

Cover crops :

- 4 mixtures of 2 or 8 species, with and without legumes

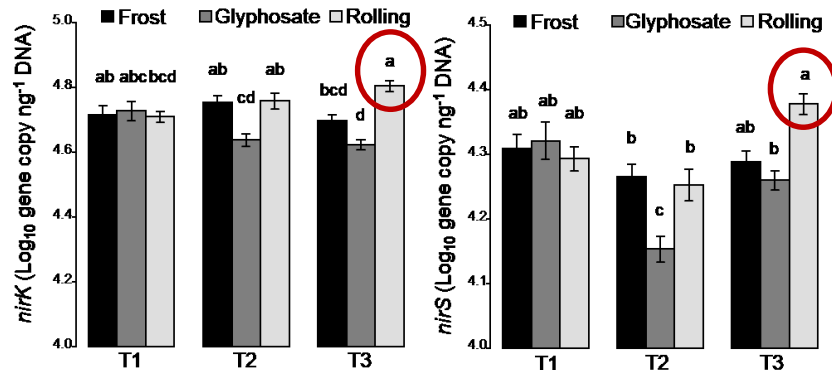
Water resources :

- Dry sowing
- Irrigation (40 mm)

Cover crop termination:

- Frost
- Rolling
- Glyphosate

	PD			Simpson R			Richness			Abundances		
management practices	df	F	P	df	F	P	df	F	P	df	P *	% Genus
Cover crops	4	2.22	NS	4	1.68	NS	4	3.65	<0.05	4	<0.05	1 % (2)
CC Termination	2	0.88	NS	2	4.43	<0.05	2	0.25	NS	2	<0.05	19 % (55)
Irrigation	1	0.52	NS	1	3.61	NS	1	1.88	NS	1	<0.05	10 % (28)



Cover crop management practices are more important drivers of both composition of the total bacterial community and abundance of N-cycling microbial guilds than cover crop mixtures.

Climate Change Experiment Spain

H: Soil legacy effects of diverse crops will increase the resistance of ecosystem multifunctionality to Climate Change



Soils from: 3 locations with 2 Crop div. (High vs Low)

Pots under 2 Temp. conditions (Warming vs control)





Climate Change Experiment Spain

This graph shows the effect of agricultural diversification and warming on soil variables and microbial richness (unpublished results – please contact the coordinator for further information).



Outreach

1) Day of subterranean life in Switzerland for citizens and farmers, including the international campaign soil your undies:

**This event received a lot of media attention and was broadcasted various times on the main television stations in Switzerland;*

**contributions on 15 different radio-stations;*

**coverage in many newspapers.*

**This led to a new citizens science project testing the impact of soil biodiversity and soil quality on plant yield and soil functioning.*

1) Final Conference of the consortium: Below and above ground diversity for Sustainable Ecosystems (Zurich, 14 & 15 November)

**with 4 Biodiversa consortia attending (DIGGING DEEPER, SOILMAN, SOILCLIM, BIOINVENT)*

**invited talks from key players and policy makers in this research field including: Richard Bardgett, Claire Chenu, Peter de Ruiter, Franciska de Vries, Tom Crowther, Urs Niggli, Eva Reinhard, Nico Eisenhauer, Matthias Rillig, Fernando Maestre, Sara Hallin, Maarja Opik, Marcel van der Heijden, Laurent Phillippot, Klaus Birkhofer, Eric Allan*





Stakeholder Engagement

- 1) *At a national level we discussed with farmers and policy makers about relevant research questions with practical value (e.g. importance of cover crops and crop cover)*
- 2) *We sampled at farmers fields (e.g. in Switzerland, France and Germany)*
- 3) *We organised farmers days about sustainable farming systems and crop diversification (including cover crops) in Spain (Oct-2019, 6 talks and more than 25 attendees including 8 institutions/companies), Sweden (May 17, 2018 100 attendees), France (various meetings) and Switzerland (cover crop field trial in 2017, diverse presentations including for farmers 2018).*
- 4) *Presentation of Digging Deeper at Lönnstorp Research Station in Sweden, incl site visit (May 2017). Lönnstorp is dedicated to studies of cropping systems ecology, with a focus on the design, sustainable development and assessment of arable cropping systems and one of the D_D sites*
- 5) *Student visit to the Climate Change Experiment in Spain during the Annual Science Fair (2017-2018). Various Master Students contributed to this project*
- 6) *The analysis of the results is almost complete and at future meetings we will inform farmers, policy makers and scientists about the results and the potential and limitation of biodiversity for ecosystem sustainability*



ACKNOWLEDGEMENTS

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National Funding Organisations for funding:

