

**sDiv workshop**  
**"Importance of rare microbes for soil ecosystem services"**  
**(sRareBios)**  
**November 25-28, 2014**  
**Workshop Summary**

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### **Focal areas of discussion, main results/conclusions + open questions**

The workshop started with a round of expectations, identifying the open questions. What causes rarity, what is the function of rare microbes for ecosystem functioning, how do they contribute to stability, which traits are associated with rare species, what are the co-existence mechanisms, how can we manage rare microbes?

We discussed the pro's and con's of defining a threshold for rare bacteria. Regarding the definition of rare bacteria, we agreed that creating categories of a continuous variable is artificial. In studies of the rare biosphere the categorization is partly triggered by the cut-off point below which data are ignored in order to reduce noise due to technical artefacts. Categories could be used for making comparisons between the extreme ends of the distribution ('dominant' vs 'rare'). The conclusion was that multiple thresholds should be used to test the robustness of any conclusion regarding the rare end of the tail (e.g. Gobet et al 2010 Nucl Acid Res).

Also molecular methods and the bioinformatics were discussed to better detect rare microbes. It was interesting to learn that different standards apply regarding singletons between e.g. aquatic and terrestrial researchers. It was suggested to have different similarity levels for the rarefaction curves to explore the origin of singleton. Several suggestions were made to separate artefacts from real species. Also the proportion between DNA/RNA could be used to identify and investigate the activity of rare species. Different empirical approaches were discussed to quantify the contribution of rare species to overall biodiversity and functioning. The importance of local rarity, by scaling down and looking into aggregates was discussed. For a more empirical approach to issues about rarity, the importance of cultivation and re-assembly was stressed. Besides those fundamental studies in the lab, the study of rare species in the field via labelling was mentioned.

On day 3 the synthesis of datasets was discussed, in order to find global patterns for rare microbes. How can we identify traits belonging to rare species, using information that is currently available? On day 4 individual datasets were investigated and different approaches for analysis were discussed between participants in small groups.

On day 4 the use of the rare microbiome in soil as a central core for a multidisciplinary collaborative network was explored. A list of methods and possible partners (SMEs) was compiled.

## Summary of presentations

In total there were 9 presentations divided over 3 days

The first set of presentations focused on ecological theory

1. Rare species in biodiversity-functioning relationships – keystone species and insurance **Viola Kurm**
2. The importance of niche and neutral processes and neutrality for community assembly and biogeography **Laure Gallien**
3. Rarity as strategy - evolution of rare microbes **Mattias Rillig**

The next presentations went more into detail regarding different habitats: the rare biosphere in soils and humans.

1. Rare biospheres of soils and sediments **Angelique Gobet**
2. The role of rare microbes in human health and disease **Damian Rivett**

This was followed by presentations focusing on molecular methods and ways to manipulate rare microbes in order to study their relevance

1. Molecular methods **Noha Youssef**
2. Manipulating rare microbes **Joana Falcao Salles**

Finally there were two presentations with case studies, presenting data exploring the role of rare species.

1. Microbial community in sediments from contaminated freshwater system – role of rare species **Xiaowei Zhang**
2. Role of rare species in the breakdown of pollutants **Alex Jousset**

The iDiv Seminar on Wednesday afternoon was given by Marcel van der Heijden on the multifunctionality of mycorrhiza.

## Outputs and workplan

A review paper (including meta-analysis) with contributions from all workshop participants is in preparation. This is coordinated by Alex Jousset and Gera Hol. The outline was made during the workshop. Tasks were distributed over small writing groups and text for the different sections will be contributed by January 15, 2015. A full draft is expected by February 15.

There is a second idea for a more thematic manuscript. 24 Dec is the deadline for input for this manuscript.

Finally the option of a MSCA-ITN proposal was explored. We decided that the upcoming call, with deadline January 2015, was not a realistic aim. Therefore it was decided to work this further out during the coming year and go for the next round. This will be explored in the coming months, and probably a short meeting will be organized to get the academic and commercial partners together.

## General working atmosphere and feedback on sDiv-support

The atmosphere was very good. It is a very productive environment, with good facilities and excellent catering.

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Chatzinotas	Antonis	Helmholtz Centre for Environmental Research - UFZ	Germany
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Gallien	Laure	Swiss Federal Research Institute WSL	Switzerland
Gobet	Angelique	Station biologique de Roscoff - CNRS	France
Hol	Gera	Netherlands Institute of Ecology	The Netherlands
Jousset	Alexandre	Utrecht University	The Netherlands
Kurm	Viola	NIOO-KNAW	The Netherlands
Küsel	Kirsten	University of Jena	Germany
Rillig	Matthias	Free University Berlin	Germany
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