

BASIC PREREQUISITES OF A SEMI-FIELD TERRESTRIAL MODEL ECOSYSTEM (TME): ECOLOGY, VARIABILITY, TECHNICAL SET-UP & RESULTING TEST STRATEGIES

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Introduction

- Semi-field test systems are more and more discussed to derive **structural endpoints**
- **Terrestrial Model Ecosystems (TME)** are currently proposed as a higher-tier testing option to detect side effects of pesticides on the **soil community**
- We **compared** data from field & TME samples in order to investigate the stability of the TME test system
- We present **evaluation of techniques** by statistical considerations & qualitative analyses
- We propose a **study design** which is capable to detect effects on soil communities

Data base

- **Field samplings** on the TME coring area (~300 Samples from 2004-2006).
- **TME samplings** (~300 samples of **untreated TME** from 2005-2007).
- **Endpoint: Abundance** of Oribatid mites, Collembolans, Gamasid mites, Nematodes & Enchytraeids.
- **Endpoint: Community structure** of Oribatids, Collembolans, Enchytraeids (determined to species level) & Nematodes (feeding guilds).

1 Do we have appropriate techniques?



Fig. 1: TME-soil cores are taken with minimal disturbance



Fig. 2: Quality of extraction has been running through internal optimisation & cross validation experiments

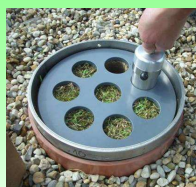


Fig. 3: Sub-samples are cored and extracted according to ISO guidelines. Sequential sampling procedure (non-destructive sampling, no pseudo-replicates) has been evaluated

Conclusion

- Techniques have been **optimised** according to available data
- **Humidity** as limiting factor of soil animal reproduction has been monitored
- Irrigation has been taken place in case of permanent drought following a general **minimal disturbance dogma**

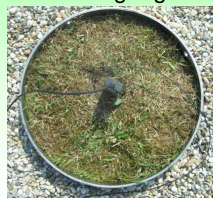
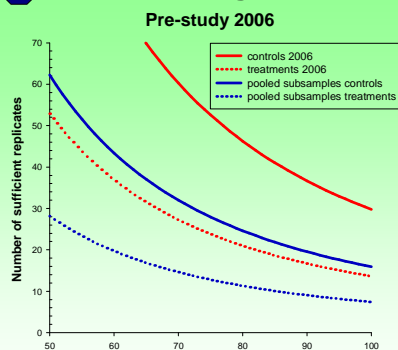


Fig. 4: Measuring instrument to monitor matrix potential



Fig. 5: Facility is well drained & assures sufficient water tension

2 How to manage intrinsic variability?



Conclusion

- **A priori power analysis** of **pre-sampling** data was identified as essential to further adjustments of sampling design
- **Pooling** of sub-samples considerably **reduces variability**
- In order to enhance statistical power **dose-response design** was applied in 2006

Fig. 6: Pooling of sub-samples reduces within-treatment variability by average 20% (empirical & modelled). Red lines: baseline variability (as COV) TME test 2006, Blue lines: variability of pooled samples pre-sampling spring 2007; Statistics: Dunnett's t-Test procedure.

3 How to handle spatial variability?

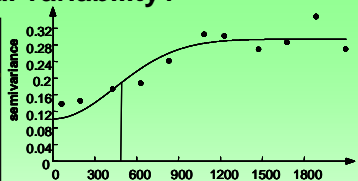
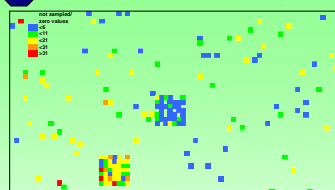


Fig. 8: Semivariogram of *I. palustris* on the coring area. Dots: experimental results. Line: Modelled function (Gaussian). Vertical line defines distances with high similarity, supposing fast decreasing correlation between samples in a distance of more than 5 meters.

Conclusion

- Soil organisms are not randomly distributed over the coring area
- **Patchiness** occurs on small (< TME) and big scales (>TME)
- **Coring strategy** has been adjusted to a 5 x 5 m area to avoid big-scale variability

4 Do TME maintain stable communities over time?

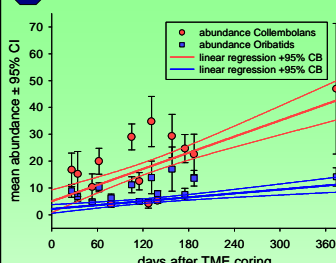


Fig. 9: Duration of community isolation tends to result in an increase of abundance of both Oribatid mites & Collembolans. Data of two consecutive growing seasons (controls).

group	species name	days after TME coring			
		26	53	115	175
O	<i>Galumna obvia</i>	X	X	X	X
C	<i>Isotomurus palustris</i>	X	X	X	X
C	<i>Isotoma spec.</i>	X	X	X	X
O	<i>Scheleobates laevigatus</i>	X	X	X	X
C	<i>Brachystomella parvula</i>	X	X	X	X
C	<i>Isotoma viridis</i>	X	X	X	X
C	<i>Isotoma anglicana</i>	X	X	X	X
C	<i>Lepidocyrtus cyanus</i>	X	X	X	X
E	<i>Fridericia christeri</i>	X	X	X	X
E	<i>Fridericia galba</i>	X	X	X	X
E	<i>Fridericia bisetosa</i>	X	X	X	X
E	<i>Fridericia bulboides</i>	X	X	X	X
E	<i>Hentles pepusilla</i>	X	X	X	X
E	<i>Enchytraeus buchholzi</i> agg.	X	X	X	X
E	<i>Fridericia sp. juv.</i>	X	X	X	X
E	<i>Fridericia paroniana</i>	X	X	X	X
E	<i>Marionina communis</i>	X	X	X	X
E	<i>Achaeta unilobula</i>	X	X	X	X
E	<i>Lepidocyrtus lanuginosus</i>	X	X	X	X
O	<i>Achipteria coleoptrata</i>	X	X	X	X
O	<i>Entomobrya spec.</i>	X	X	X	X
O	<i>Sminturinthus aureus</i>	X	X	X	X
O	<i>Sminturinthus viridis</i>	X	X	X	X
O	<i>Platynocheilus petifer</i>	X	X	X	X
O	<i>Lebstadia similis</i>	X	X	X	X
O	<i>Deuterosminthurus repandus</i>	X	X	X	X
O	<i>Pelops occultus</i>	X	X	X	X
O	<i>Sphaeridia pumilis</i>	X	X	X	X
O	<i>Enchytraeus minutus</i> agg.	X	X	X	X
O	<i>Minuticoxates semirutus</i>	X	X	X	X
O	<i>Oribatidae juv.</i>	X	X	X	X
O	<i>Frisea mirabilis</i>	X	X	X	X
E	<i>Isotomiella minor</i>	X	X	X	X
C	<i>Lepidocyrtus lignorum</i>	X	X	X	X
C	<i>Pseudoscorpiones subcrassus</i>	X	X	X	X
C	<i>Parisotoma notabilis</i>	X	X	X	X
C	<i>Desoria trispinata</i>	X	X	X	X
C	<i>Orchesella spec.</i>	X	X	X	X
C	<i>Tomocerus minor</i>	X	X	X	X
C	<i>Fridericia singula</i>	X	X	X	X
E	<i>Enchytraeus minor</i>	X	X	X	X
E	<i>Fridericia ulrikae</i>	X	X	X	X
E	<i>Marionina argentea</i>	X	X	X	X

Conclusion

- TME **abundance** is considered as **stable** over a period up to 1 year after coring
- Number of **>30 species** **constantly present** in the systems

Tab. 1: Species list of 2006 dose-response experiment (controls). O=Oribatid mites; C=Collembolans; E=Enchytraeids. Dark grey: Very steady occurring (3-4 sampling dates); Light grey: Steady (2 dates); Hatched: not sampled.

Summary

- All methods have been **optimised** by internal & external validation
- **Intrinsic variability** has been **lowered** and study design is changed to **EC_x design**
- **Spatial variability** was quantified by means of screening studies & **coring strategy** was adapted to avoid additional variability
TME are **considered as stable** over time periods up to one year
- Species inventory provides **diverse communities**