



# Spatial distribution of earthworms and their effects on water infiltration patterns

Anne-Kathrin Schneider<sup>1</sup>, Loes van Schaik<sup>1</sup>, Anne Zangerlé<sup>1</sup> and Boris Schröder-Esselbach<sup>1,2</sup>

<sup>1</sup> Technische Universität Braunschweig, Institute for Geoecology, Environmental System Analysis

<sup>2</sup> Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), 14195 Berlin, Germany

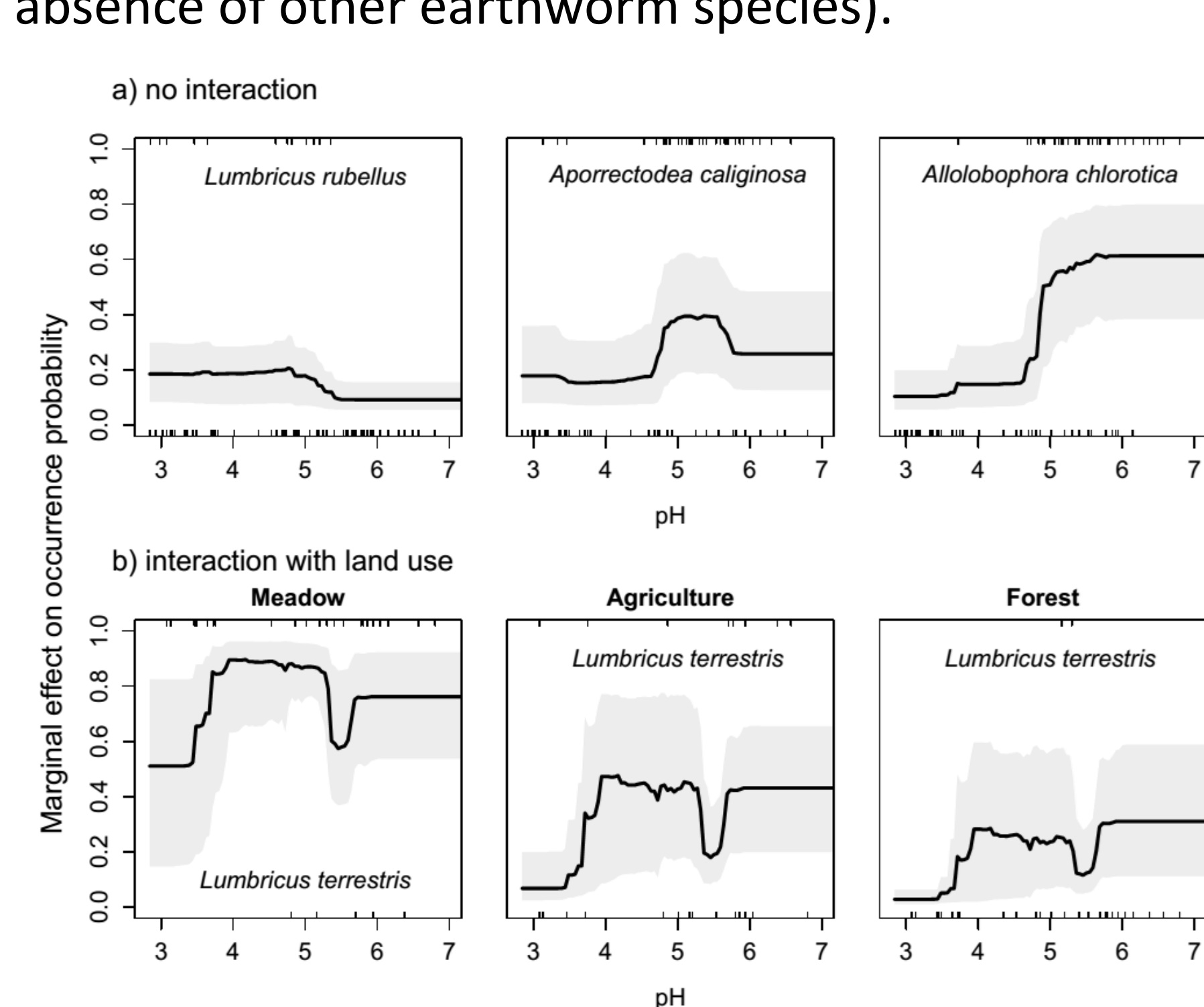
**Motivation** Earthworms affect various soil physical, chemical and biological states and processes in soils. Through their burrowing behavior they create aggregates and macropores.

This study aims to predict the spatial distribution of earthworms in the Attert catchment as a first step for the investigation of the functional effects of earthworms on soil hydrological processes at landscape and catchment scale.

**Hypothesis** Earthworm occurrence probabilities can be predicted by relating the presence-absence measurements with (i) abiotic factors measured at plot scale, (ii) abiotic factors derived from GIS data, and (iii) biotic factors (presence-absence of other earthworm species).



**Fig. 1:** Probably earthworm induced infiltration pattern (dye-tracer rainfall experiment).



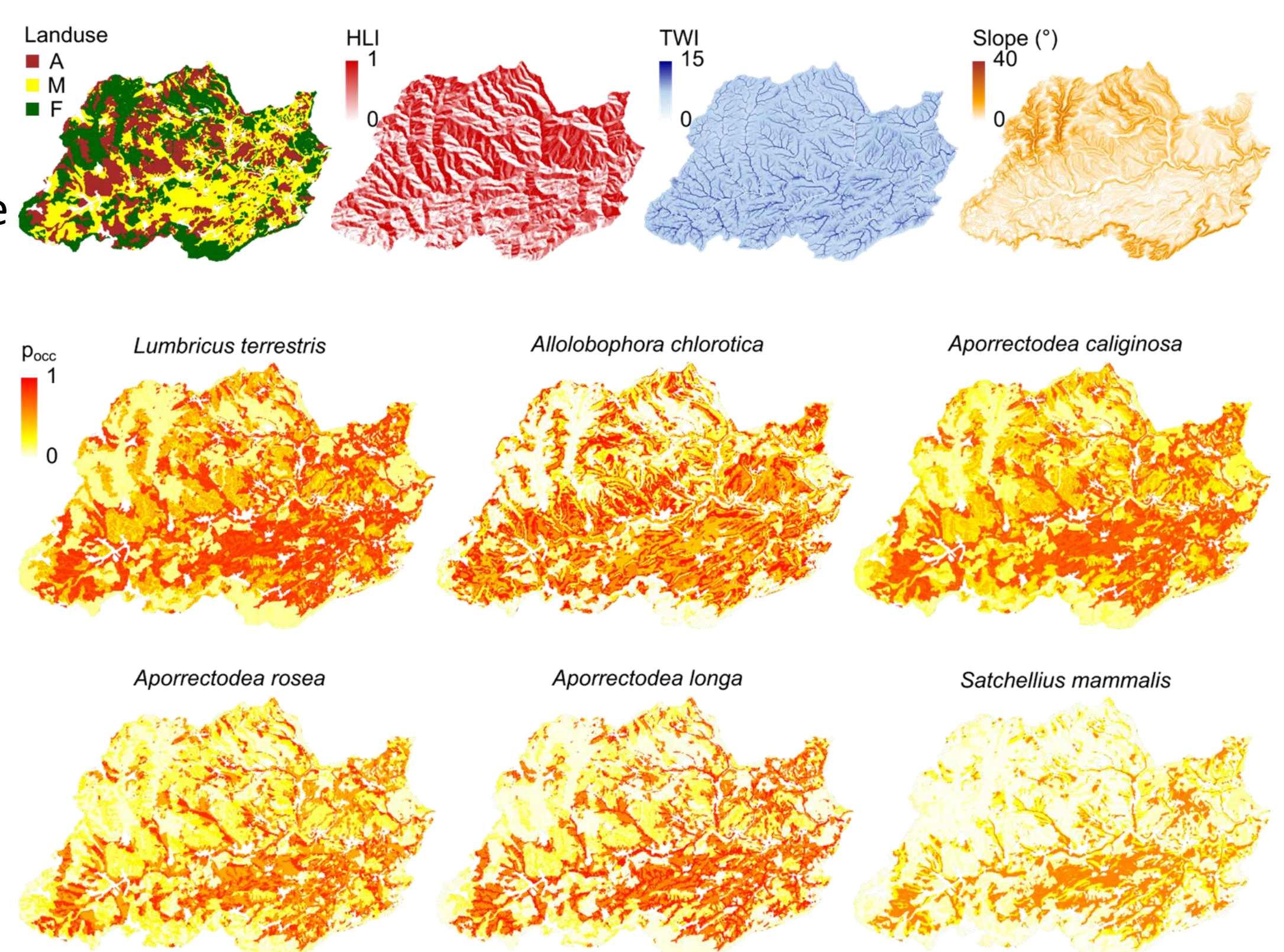
**Fig. 2:** Partial dependence plots for predicted pH responses based on the plot scale BRTs. Grey area: 90% confidence interval.

## Results & discussion

- Seven from 10 species could be modeled yielding adequate model performances ( $AUC > 0.7$ ), acceptable explained deviances (20-50%) and reliable response curves
- Plot scale predictors resulted as most important predictors
- Responses partly hard to interpret (e.g. occurrence minimum at pH 5.5 for *L. terrestris*)
- Unexplained deviance: small-scale distribution of earthworms patchy, dispersal and recolonization processes, variability of subspecies
- Temporal transferability for almost all species poor: temporal population dynamics and activity patterns

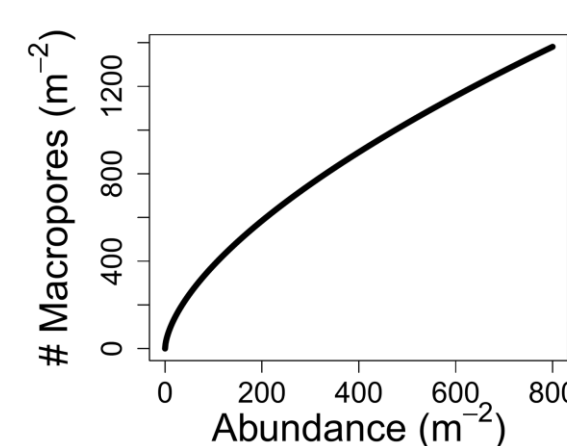
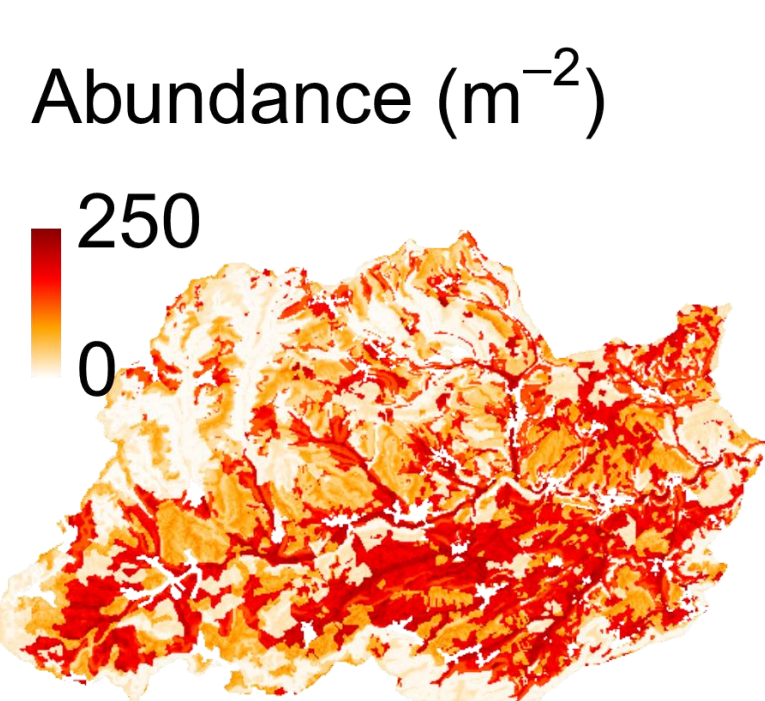
## Spatial distribution modeling of earthworms using boosted regression trees

- 81 replicates in April/May 2013
- 10 earthworm species (out of 17 species)
- Presence-absence data
- 3 predictorsets: i) plot scale data, ii) GIS-based data, iii) biotic interactions + iv) combined set
- Variable selection via gbm.simplify
- Model performance criteria: Explained deviance and ROC-AUC after 10-fold crossvalidation
- Partial dependence plots with bootstrapped confidence bands (1000 bootstrap replicates)
- Testing temporal transferability using data from autumn 2012 and 2013

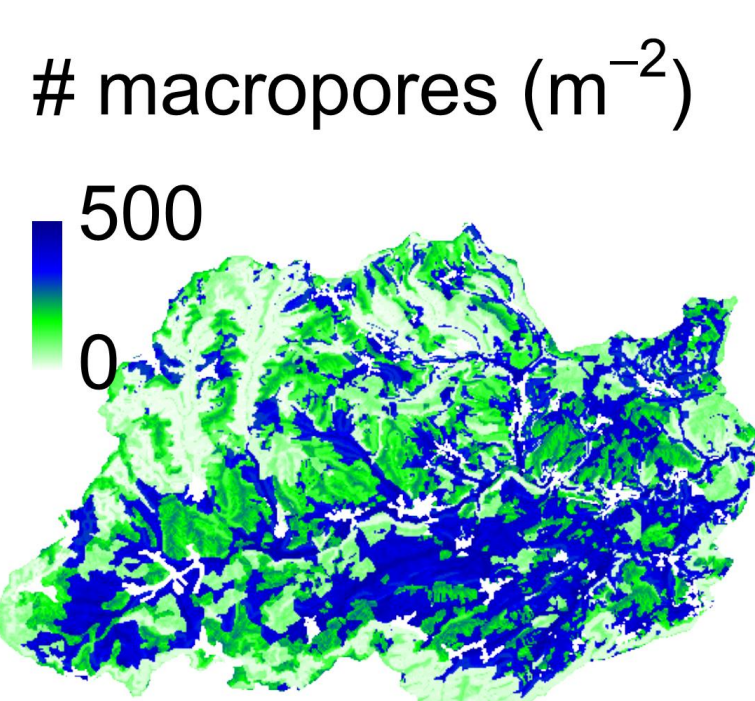


**Fig. 3:** Predicted occurrence probabilities of single species in the Attert catchment based on the GIS-based BRTs.

## Linking spatial distribution of earthworms with their functional effects



$$\# \text{ Macropores} = \left( \frac{21.9}{\text{Abundance}} \right)^{-0.62}$$



**Aim** Predicting occurrence and strength of earthworms' functional effects (i.e. effective macropores) using e.g. transfer functions or integrated modeling approaches.



INSTITUTE OF GEOECOLOGY  
Environmental Systems Analysis

