Soil functioning and species redundancy in contaminated soils; the relevance of vertical heterogeneity

Diane Heemsbergen#, Jack Faber#, Matty Berg* & Herman Verhoef**

Introduction

Soil quality assessment overlook soil heterogeneity. In stratified contaminated conditions, as occurring in river floodplains, site-specific ERA is hampered by lack of knowledge about field exposure of soil fauna. Vertical distribution of soil animals, and ecological functioning of exposed species may be affected through changers in community composition.

Avoidance of contaminated layers

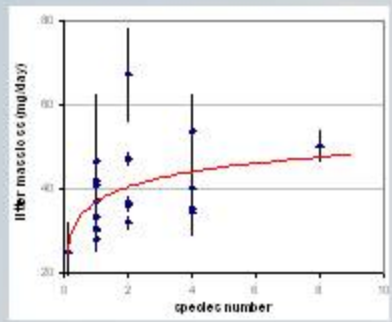
Vertical avoidance of contaminated layers by earthworms was not observed in field nor laboratory. Soil bioturbation was observed in contaminated layers.

Community structure and soil processes

Earthworm community structure in the field could not be related to contamination, as the distribution of contaminants in river flood plain soils is strongly associated with SOM, clay and soil moisture.

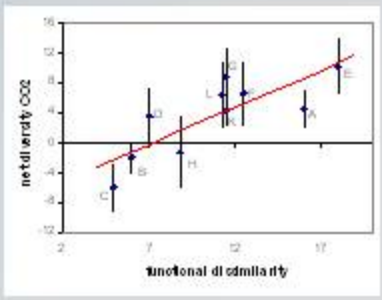
Functional consequences of species loss within the functional group of soil macrofauna detritivores were tested. Soil process rates saturated at low species numbers, suggesting **species redundancy**. The earthworm *Lumbricus rubellus* was a **key species** in all soil processes. Many species interactions were observed. Seemingly redundant species may therefore still be significant through functional interactions with key species.

Soil functioning may be predicted using **functional biodiversity**: in reduced communities soil processes can be maintained if the species assemblage is sufficiently *functionally* divers.



Ecosystem engineers driving environmental heterogeneity

The earthworm *Aporrectodea caliginosa* affected soil organic matter contents and therefore soil moisture. Potentially, bioavailability of contaminants may also be affected (not measured). This suggests the importance of **ecosystem engineering species** as they can actively change soil characteristics, and ecological risks.



Our contribution to site-specific ecological risk assessment for floodplains

Lack of avoidance consequentially results in exposure to contaminants, possibly resulting in higher body burdens and food chain transfer of contaminants. Heterogeneity in contamination should be taken into account in site-specific ecological risk assessment .

Changes in community composition by contaminants could not be excluded as key edaphic factors are correlated. Ecological functioning of soil detritivores does not appear to be reduced. However, as functional diversity within this group in floodplain grasslands is limited, soil ecosystem functioning may be vulnerable since the presence of the key species is critical and "spare wheels" are not provided.

 # Alterra, Centre for Ecosystem Studies, PO Box 47, NL-6700 AA Wageningen
** Vrije Universiteit, Institute of Ecological Science, De Boelelaan 1087, NL- 1081 HV Amsterdam*

For more information: Diane Heemsbergen, CSIRO ,PMB 2, 5064 SA Australia. Email: diane.heemsbergen@csiro.au