AquaTerra

AquaTerra is an EU-funded integrated project that aims at a better understanding of the groundwater-soil-sediment-river system as a whole by identifying relevant processes, quantifying the associated parameters and developing numerical models of the system to identify adverse trends in soil functioning, water quantity and quality. With an integrated modelling system, AquaTerra provides the basis for improved river basin management, enhanced soil and groundwater monitoring programs and the early identification and forecasting of impacts on water quantity and quality during this century. Within this European framework the sub-project TREND focuses on:

1. understanding the temporal variability of floodplain soil parameters, relating land-use and soil erosion to these parameters and the effect on soil and sediment ecological functioning
2. understanding the temporal variability of micropollutant concentrations in floodplain soils and sediments due to inundations, and address bioavailability to soil (Lumbricidae) and sediment (benthic) biota
3. understanding resilience of natural cycling processes in soils and sediments, towards perturbation, contamination and inundation, taking organic matter mineralization as the model functional process to investigate this phenomenon
4. developing Integrated Quality Indicators (IQI), indicative for trends in ecological functioning in sediments

For objective 2, emphasis is on the bioavailability of micropollutants (in particular Cd and Zn) and carbon dynamics. The core is a monitoring program (selected Meuse, Elbe, Danube sites) to characterise the temporal variability of micropollutant mobility and bioavailability in periodically flooded river-soil systems. For sediments, elaborate techniques to characterize metal availability (ratio of Acid Volatile Sulfide and Simultaneously Extracted metals, AVS/SEM) and organic pollutant availability (6 h Tenax test) will be applied. Implications for ecological risks will be addressed, including effects in neutral red retention (NRRT) assay and effects on ecosystem functions such as reduced mineralisation and community characteristics.

Previous research has demonstrated that the health of earthworms can be assessed relatively easily using the so-called neutral red retention assay, applied to coelomocytes taken from the body cavity. This assay, which measures the stability of the lysosomal membrane and hence cell viability, has shown to be a very reliable sublethal and sensitive indicator, which is well correlated with the level of total sediment pollution. The advantage is that the test can be done using animals collected directly in the field. There is a need for extending the scope of the assay by (1) establishing causal links with the bioavailability of sediment pollution, (2) performing an ecological calibration, relating the neutral red assay to the bioturbation and mixing function of earthworms, (3) investigating the variability of the assay in space and time, and (4) developing an energy-budget based model by which ecological functions of earthworms may be predicted under different scenarios. A set of study sites will be chosen (see Dommelweb), in conjunction with the sites selected by other partners, at different places in the river basins and NRRT tests will be done repeatedly at one site and along several sites, using selected species of earthworms. At each site inventories will be done of bioavailability of soil pollution and earthworm activity.

In 2005 four sites in the Dommel catchment have been intensively monitored (see Dommelweb): every four weeks earthworm densities as well as soil properties were determined, including metal content of the soils and earthworms (Cd, Cu, Fe, Ni, Zn). Major findings of this survey were that earthworm densities are mainly determined by
moisture, organic matter and clay contents of the soils and to a much lesser extent by metal concentrations. Furthermore, internal metal concentrations in the earthworms were too low to induce an effect in the neutral red retention time of the earthworm *Lumbricus rubellus* (see for details Bleeker & Van Gestel, *Environ. Pollut.* 2008. Research also focused on bioassays with *Eisenia andreii* exposed to different field soils from the Meuse and Elbe basins (see Dommelweb) in which feeding behaviour neutral red retention time are scored as endpoints.

**Duration:**

4 years (June 2004-May 2008)

**Participants:**

Eric Bleeker, Kees van Gestel, Diana Slijkerman (TNO-IMARES), Andrea Sneekes (TNO-IMARES), Anton Poot (WUR), Bart Koelmans (WUR)