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Importance of rodents for hydrology: lessons learnt from various field experiments

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organisms are known to create soil macropores of different sizes and with varying extent and orientation: most commonly earthworms, rodents, moles and roots. Preferential flow through macropore networks is dynamic and typically occurs when short individual macropores become connected at the hillslope scale as the nodes between the macropores become wet. Large lateral macropores may contribute to rapid subsurface stormflow of water and solutes at hillslope scale and supply a significant part of the catchment scale discharge during high intensity rainfall events even under relatively dry catchment state. Outflow from soil pipes, especially in the valley bottom or along the banking near to streams, is frequently observed, however, it remains a challenge to measure the spatial distribution, extent and connectivity of macropores at hill slope scales. We hypothesize that local information on organism abundances may be used as an indicator for spatial variability in infiltration, water storage and fluxes at the small scale and that knowledge on the landscape scale spatial distribution of organisms can provide information on connectivity of macropores at hillslope scale.

Here we summarize the lessons learnt during three years of measurements aimed at determining the influence of rodent burrows on soil hydrology in a meso-scale catchment. Within the Attert Catchment (297 km2) in Luxembourg we performed sprinkling experiments with a brilliant blue tracer on twelve plots, of which six directly above rodent burrow openings and six on a surface without a rodent burrow opening, in order to examine the influence of the burrow openings on the infiltration pattern. Then we tested the extent of flow through mice burrows in different forest types, with varying geology and slope, by supplying 5 Liters of water with brilliant blue tracer directly to 24 burrow openings at soil surface. We excavated the burrows to measure how far the water was transported laterally in the burrow.

Though we have serendipitous evidence of lateral water flow through large macropores in deeper soil layers from other projects, with the experiments we performed with the purpose to characterize this, the water did not seem to infiltrate into the burrow openings at the soil surface at all and the infiltration pattern under burrows was not different from that in soils without these openings. The five liter of brilliant blue dyed water which we poured into burrow openings did not flow far into the burrows, it generally infiltrated straight away into the surrounding soil. These results seem to show that the infiltration of water to rodent macropores during high intensity events does not take place at the soil surface but rather through other macropores, e.g. earthworm channels, which connect to deeper lateral channels. Also the lateral flow of water through the rodent burrows is apparently more effective in the deeper soils, where we occasionally saw a burrow with completely blue walls but little infiltration into the surrounding matrix.