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The “Point Zero”: Monitoring of biogeochemical patterns and processes in an initial ecosystem (Lusatia, Germany)

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Ecosystems are highly complex systems composed of many different abiotic and biotic compartments that are closely linked by interacting processes and co-develop over long-term periods. Most integrating studies have been carried out in ´climax´ ecosystems and only limited knowledge exists about the initial phase of ecosystem development although it is hypothesized that the conditions at ´point zero´ and the processes of the initial phase determine and control further development. ‘Point zero’ of the ecosystem development was analysed at e.g. volcanic regions of Hawaii, Mount St. Helens and Iceland and also in glacier retreat areas in the Arctic, Antarctic and the Alps.

The attempt to study patterns and processes of initial ecosystem development at an artificial catchment is a novel approach to disentangle the complex interactions and feedback mechanisms typically found in mature ecosystems and to understand the relevance and importance of initial conditions on further development and future state of an ecosystem. The watershed approach allows to integrate the relevant processes with related pattern and structure development over temporal and spatial scales and to derive thresholds and stages in state and functioning at the catchment level. To allow the clear definition of as homogeneous as possible starting conditions at ´point zero´ and to be able to integrate spatially distributed processes and patterns to larger units, an artificial catchment was constructed in the mining area of Lusatia, Germany. This artificial catchment ´Hühnerwasser´ with an area of about 6 ha was constructed as a 2-4 m layer of post-glacial sandy to loamy sediments overlying a 1-2 m layer of Tertiary clay that forms a shallow pan and seals the whole catchment at the base.

A comprehensive monitoring program is carried out in the catchment including: meteorology, atmospheric bulk deposition, dust deposition, grid soil sampling, soil solution chemistry (ions, DOC, TOC, grain size, etc.), soil water (TDR, tensiometers), hydrology (stream flow, groundwater, water quality, etc.), erosion, and limnology (water quality). Furthermore, the establishment of higher vegetation (species, pattern) and soil fauna (species, abundance) are investigated and will be related to the physical-chemical soil development. The gathered data are the basis for the calculation of water and element fluxes in the ecosystem and their interactions with the formation of observed structures. A special focus will be on the interactions of the biogeochemical processes on different scales. First results will be presented and discussed.