EXPLORING THE CARBON DYNAMICS OF KETTLE HOLES

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One of the studied kettle holes in the Uckermark region

The kettle holes of Northeast Germany, i.e. small lakes in depressions, can be long-term sinks of organic carbon: organic remains are hardly decomposed in the oxygen-poor sediment. However, a small proportion may be emitted as climatic relevant methane. In addition, some carbon is released when kettle holes dry out. In their joint project, scientists of ZALF and IGB took a closer at these processes.

The project focussed on intense studies of two kettle holes in the Uckermark region, supplemented by laboratory experiments and a variety of water, plant, and soil samples analysed for various elements and isotopes. The primary objective was to quantify the input of organic carbon via soil erosion, photosynthesis in the kettle holes, and via groundwater influx as well as the carbon output via decomposition, methane emissions or groundwater efflux. In addition, the drivers of carbon turnover in the kettle holes were to be determined in order to assess the future development assuming different scenarios.

To that end, the project studied the transfer of soil material in the vicinity of the kettle holes, quantified the input via sediment probes and sampling of suspended matter, and measured organic carbon built up by plants and algae. The source of organic matter in water and soil was determined using carbon and nitrogen isotopes. Gaseous carbon release from the kettle holes and their surroundings was quantified by means of gas exchange measurements. Additional periodic sampling of another 60 kettle holes in the region allowed assessing the representativity of the results. Field studies and lab experiments showed that carbon and nutrient turnover in the kettle holes highly depended on the length of preceding desiccation phases. Based on the measured data, a biogeochemical model to simulate these turnover processes was set up and calibrated.

In general, the kettle holes exhibited an enormous spatial and temporal variability. Even adjacent kettle holes can differ substantially. Moreover, kettle holes are closely linked to their surroundings, which are often intensively agriculturally used. Despite the high variability and complexity, the LandScales project developed initial approaches to transfer findings from a few kettle holes to larger regions.

Kettle holes are hotspots of biodiversity and of biogeochemical processes in agricultural landscapes.

Project: Connecting processes and structures driving the landscape carbon dynamics over scales (LandScales) **Term:** 2012–2016 **Funding:** Leibniz Association **Lead:** G. Lischeid (lischeid@zalf.de) **Partners:** IGB **ZALF contribution:** LWH, LBG, BLF