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Hydro-physical properties of temperate hardwood floodplain forest soils in a dry summer season

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Understanding the influence of habitat properties on the dynamics of terrestrial ecosystems is a fundamental part of ecosystem research under climate change, especially in areas of high environmental heterogeneity, such as floodplains. The present research is part of the collaborative and interdisciplinary MediAN project (Mechanisms of ecosystem services in hardwood floodplain forests: Scientific analysis and optimization of conservation management), where topics regarding carbon storage of soils and tree biomass, as well as tree vitality and the diversity of herbaceous vegetation are investigated. Thus, in this study we aim to understand and characterize the causes and effects of biotic interactions in relation to the edaphic site properties - in particular between the soil water balance and hardwood forests.

In this context, we identified the spatiotemporal variability of soil hydro-physical properties in six active and former hardwood floodplain forest sites in the Middle Elbe River, Germany. The study sites represent the floodplain geomorphology, therefore varying in elevation (high and low sites), soil texture and hydrological properties, as well as in forest age. We opened three soil profiles per site and installed soil sensors to monitor the variation of volumetric water content (VWC), and water tension at 10 cm, 30 cm, 60 cm, 100 cm and 160 cm depth. Additionally, we installed one groundwater diver and one meteorological station per site. Undisturbed samples were taken per horizon to define the grain size distribution, bulk density and to evaluate soil moisture retention curves.

Preliminary results, from the year 2019 with an unusual dry summer season, show a clear interrelation of soil moisture retention and soil water tension with groundwater level and soil texture. For instance, a predominantly sandy site, located in the high active floodplain, displayed VWC values below 8% throughout the vegetation period and at all depths. Water tension showed higher variation at 10 and 30 cm (2-3.25 pF) compared to deeper soil, which is directly related to precipitation events. These initial observations imply local water stress for the floodplain vegetation; therefore, physiological stress on woody species is expected. In a next step, the dynamics of soil drying will be related to xylem sap flow velocity to estimate effects on the vitality of typical hardwood forest species, such as oaks (*Quercus robur* L.) and elms (*Ulmus laevis*) at the representative study sites.