



Scour hole ('wielen') sediments as historical archive of floods, vegetation, and air and water quality in lowlands

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The sediment record from a maximum 18 m deep scour hole lake (Haarsteegse Wiel) near the embanked Meuse River in the Netherlands was studied for past changes in flooding frequency, water quality, and landscape change using a combined geochemical, geobiological and historical approach. The results are highly significant for determining long-term trends of river flood frequency, eutrophication, atmospheric pollution, and vegetation development. Haarsteegse Wiel consists of two basins connected by a shallow sill. The first flooding event is indicated in the sediment at AD 1610 when the 8 m deep southern basin of the lake was created by flood water masses bursting through the embankment. In AD 1740 embankments burst again and resulted in the formation of the northern basin of Haarsteegse Wiel. This part of the lake was originally 21 m deep and was filled up with a 3.50 m thick sediment layer since then. The sediment was dated by combining ^{137}Cs activity measurements, biostratigraphical ages of pollen, microtephra, and historically documented floods indicated by the magnetic susceptibility of the sediment. The resulting chronology is highly accurate and shows that sedimentation rates decrease sharply with the widespread change from cereal cultivation to pasture land from around AD 1875 (agricultural crisis) as a direct result of falling wheat prices and intensified cattle farming. Water quality (total phosphorus concentration) was reconstructed using a diatom-based transfer function. Results show that the currently nutrient enriched lake has mostly been in a mesotrophic state prior to AD 1920, with the exception of several sharp eutrophication events that are generally coeval with river floods. After 1920, eutrophication of Haarsteegse Wiel is clearly documented and generally caused by the increased population, enhanced use of fertilizers and settlement of dairy industry in the region. Industrial development in both the vicinity and the hinterland of Haarsteegse Wiel since ca. 1880 is also well documented by the accumulation of SCP (Spheroidal Carbonaceous Particles; fly ash) in the sediment. Furthermore, river floods impact the vegetation composition by importing allochthonous components and, triggered by the influx of nutrients, clearly affect the composition of the water plant communities and aquatic species diversity.