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Small scale hydrology in a pristine and an affected peatland: effects of flood water on soil biogeochemistry

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Many peatlands have a water regime of fluctuating water levels. Flooding of peatsoils occurs in several Dutch peatlands. The quality of this floodwater is important for the ecological value of the peatlands. Well known are the eutrophying effects of polluted flood water on the N- and P- limited vegetation. Nutrients can, however, also be released from the soil; anoxic conditions are known to release Fe-bound phosphorus. It is therefore important to focus on small scale hydrology in projects where water levels are manipulated and floodings are induced. Three types of peatlands have been the subject of two separate studies on hydrology, ecological value and soil biogeochemistry. Two pristine sites and one recently restored flood water storage basin were monitored during 2009-2013. These three sites cover the natural range of peatsoils: from floating fens to degraded and fixed peat soils. All sites have peat as the main soil type, but the age and typology differs.
The two pristine sites, the Wieden and Weerribben, are characterized by limited natural and/or induced flooding events. These sites have peaty soils. The soils in the Wieden are fixed to the sandy substrate below, the peaty soils in the Weerribben are completely floating on a water layer. The ecological value of the Wieden and the Weerribben is high, but their value may decline due to low variation in water levels. The third site, the Onlanden area, is a large created storm water storage basin. The Onlanden area is a former agricultural area, inhabited since the Medieval period. It has a fixed and rather degraded peaty soil. Large scale restoration of water inlets and dams has created an area that will get flooded at regular intervals. The Onlanden was the subject of an archaeological monitoring project. All sites were equipped with monitoring stations for local and regional water levels, soil moisture and soil redox potential as the indicator for the local biogeochemistry.
Cusell et al (2013) studied the water management in the Wieden and the Weerriben National Park. They show that flooding in the study sites has an effect on the geochemistry in the peat soils, but only when soils are dry is enough before the flooding, such that water can infiltrate. There is also a strong link between infiltration capacity and the floating capacity of the fens. The monitoring in the degraded peatlands of the Onlanden showed the longer term effects of the changed regional water regime on the peatsoils. Several effects on the redox potential, vegetation and soil moisture have been found. This presentation combines the results from all three studies. It focuses on the link between hydrology and soil biogeochemistry with the redox potential as the main proxy for soil processes and shows the importance of local, small scale, hydrology in large scale monitoring projects.