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Sulphate may be a threat or blessing for seepage fed alkaline fens

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In deductive ecohydrology, experimental observations of physical and chemical conditions of sites are related with the plant species and the biodiversity of those sites. This approach integrates different disciplines, to understand how vegetation is affected by abiotic conditions. In our research, we consider a site with high biodiversity in relation with its geohydrology and biogeochemistry.
Though in Europe, atmospheric deposition of sulphur decreased considerably in the last decades, groundwater pollution by sulphate continues due to pyrite oxidation in the subsoil. Generally is assumed that the influx of sulphate rich groundwater into organic soils, poses a threat to nutrient-poor wetland eco-systems, due to sulphate reduction induced internal euthrophication and accumulation of phytotoxic dissolved sulphide in the soil. Our measurements in a very species-rich wetland nature reserve, suggest that upwelling sulphate rich groundwater may also protect alkaline fens. The explanation is that acidity produced during upstream oxidation of pyrite results in calcite dissolution and consequently elevated alkalinity and hardness of the upwelling groundwater. When this calcite saturated groundwater passes an organic-rich top-layer, alkalinity increases due to oxidation of organic matter via sulphate reduction. As a result, groundwater becomes over saturated with respect to calcite and calcite precipitates. Furthermore, potential release of phosphate from fermented organic matter is suppressed by co-precipitation with calcite and dissolved sulphides are effectively precipitated and detoxified by the extensive amount of reactive iron in the soil. In short: during soil passage, upwelling sulphate rich groundwater is transformed into a sulphate and nutrient poor water type which still contains high levels of calcium and bicarbonate. The effectiveness of the top-soil in transforming the water quality is reflected in the stability of the rare and vulnerable vegetation, which has not noticeably changed since vegetation recording started decades ago.