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Using machine learning for mapping the distribution of acid sulfate soils in northern Sweden

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In Sweden acid sulfate soils (AS soils) are mainly found along the northernmost coast. These AS soils are usually associated with organic-rich clay and silt sediments that were deposited, and reduced during anoxic conditions, in brackish-water environments. Due to the postglacial isostatic rebound potential AS soils have been uplifted in many coastal areas and can thereby be exposed to oxygen causing formation of active AS soils. The previous map of AS soils in this area are based on the distribution of clay and silt in areas that have been uplifted during the past 5000 years. However, recent studies show that AS soils are not only associated with clay and silt, but also with sand and in some rare occasions till. Furthermore, some silt and clay deposits are not AS soils.
We have tested different machine learning techniques to produce a distribution map for AS soils along the coast of northern Sweden. Maps of surficial deposits, vegetation and land-use classification based on satellite data, high resolution digital elevation model and parameters based on the elevation model were used as input data to the model and three classes were predicted: 1) No AS soils, 2) Active and potential AS soil, and 3) Potential AS soil. The model performed with different accuracy depending on the input data and ‘random forest’ appear to be the model that perform best. Large coherent areas of active AS soils are predicted to be found in artificially drained areas close to the coast. However, potential AS soil are predicted to be found up to 100 m above sea level. The new distribution map of AS soils can for example be used during planning of infrastructure projects, ditch cleaning and for recognising sites suitable for restoration of wetlands.