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Holocene environmental change and development of the nutrient budget of histosols in North Iceland

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Backround and aims: Little is known about vegetation changes in Icelandic peatlands in the context of soil chemical properties. By connecting soil chemical and physical characteristics with palaeobotanical data we examined interactions between climate, histosols, vegetation and land use during the Holocene.

Methods: Exchangeable base cations, cation exchange capacity (CEC), base saturation (BS), and decomposition rates using carbon:nitrogen ratio (C:N) and von Post humification and soil physical properties were determined. Vegetation development was reconstructed based on pollen analysis. The impact of geographic location was examined by comparing results from three sloping fens (coastal, inland and highland fringe).

Results: Minerogenic content was highest in the proximity of the active volcanic belt, reflected in higher C:N and nutrient content. The site closest to the sea revealed exceptionally high BS. C:N was either stable throughout the profile or increased with depth. Plant species richness, species evenness, and pollen concentrations were greatest at the site with lowest nutrient levels.

Conclusions: Minerogenic content facilitates the ability to bind nutrients. Lower fertility levels optimize plant growth. C:N alone is not a reliable indicator of decomposition rates, but depends on the quality of the organic parent material. Environmental conditions driven by climate changes caused alterations in vegetation and soil properties before the settlement. Nevertheless, overall the histosols showed resilience towards severe degradation. After the settlement (c. AD 870), the soils struggled to buffer the impact caused by destruction of vegetation and increased erosion. This study increases our understanding of environmental and anthropogenic determinants of soil- and vegetation development.