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Modeling relevant factors and covariates of carbon stock changes in peatlands using a hierarchical linear mixed modeling approach

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While peatlands constitute the largest soil carbon stock in Ireland with 75% of soil carbon stored in an area covering an estimated 20% of the land surface, carbon stocks of peatlands are affected by past and present disturbances related to various land uses. Afforestation, grazing and peat extraction for energy and horticultural use often are major drivers of peatland soil degradation. A comparative assessment of the impact of land disturbance on peatland soil carbon stocks on a national scale has been lacking so far. Current research, funded by the Irish Environmental Protection Agency (EPA), addresses this issue with the goal to fill various gaps related to mapping and modeling changes of soil carbon stock in Irish peatlands. Data from the first nationwide peatland survey forms the basis for this study, in which the influence of different factors and covariates on soil carbon distribution in peatlands is examined. After data exploratory analysis, a mixed linear modeling approach is tested for its suitability to explain peatland soil carbon distribution within the Republic of Ireland. Parameters are identified which are responsible for changes across the country. In addition, model performance to map peat soil carbon stock within a three-dimensional space is evaluated.