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Long term drainage alters plant biodiversity and soil C- and N-storage

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Moisture and slope position can have a strong influence on soil properties and plant communities. In a long term permanent grassland experiment, sub-surface drainage was introduced in 1982 on some plots of Rowden Moor at North Wyke (SW UK). The soil is a Stagnic vertic Cambisol with a dense clay layer at shallow depth.
After drainage the plant community had shifted from a Lolium perenne dominated grassland with patches of Juncus sp. towards a typical grassland plant community dominated by Lolium perenne and Trifolium sp. In addition, soil carbon and nitrogen concentrations significantly decreased. This is related to a smaller contribution of plant-derived organic matter to soil due to the change in plant community structure, and the enhanced mineralization of soil organic matter (SOM) under lower soil moisture. However, for C:N ratios neither plants nor soil did reveal any drainage related change arguing for an identical degradability of plant and soil organic matter.
Furthermore the δ13C values tend to get more negative in soil, which could be related to the changing plant community. For δ15N no changes were observed, which was surprising as increase δ15N values were expected due to the increase in legumes on the drained plot.
Changes in the chemical composition of SOM were also examined using compositional changes of soil n-alkanes. A shift in the alkane abundance occurs from the upper part of the slope (dominated by n-C31), to the bottom parts (n-C29 enriched). The carbon preference index and average chain length of alkanes correlated between undrained and drained plots and decreased down slope. Similarly, several alkane ratios like n-C27/n-C31 declined, due to the enhanced mineralization. Hence, the molecular pattern changed on the one hand due to changing contribution of plant derived organic matter and on the other hand because of changing preservation of organic matter in soil.
The study showed that drainage has a long term effect on the plant community leading to depletion in C- and N-contents and a change in the chemical composition of SOM.