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Pyrogenic Carbon in forest soils across climate and soil property gradients in Switzerland

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Soil organic carbon (SOC) is an important measure for soil quality. Usually a high organic matter content in soils is favourable for most ecosystems. As a very stable component, pyrogenic organic carbon (PyC) can be of major interest to investigate to potential of organic matter, to persist very long in soils. Recent studies have shown, that the mean residence time of organic matter is not only due to its intrinsic chemical nature, but also to a variety of abiotic and biotic variables set by the ecosystem. Especially for PyC it is unclear, whether its content is related to fire regime, soil properties or other climatic conditions.
In this study we wanted to investigate, how climatic and soil-related conditions are influencing the persistence of PyC in soils. Therefore we used a sample set from Swiss forest soil (n = 54), which was designed for the purpose of having most differing climatic conditions (aridity and temperature) and a large range of soil properties (pH between 3.4 and 7.6; clay content between 4.7 % and 60 %). The soils were sampled in the first 20 cm of the mineral horizon on a representative plot area of 40 x 40 m. The soils were sieved to 2 mm and dried prior to the analysis.
We used the benzene polycarboxylic acids (BPCA) molecular marker method to quantify and characterize PyC in these soil samples. Despite the large span in environmental conditions, we observed rather small differences in the contribution of PyC to SOC between warmer and colder, as well as between wetter and dryer soils. The PyC content in SOC lies well in range with a global average for forest soils estimated in other studies. Stocks of PyC vary more than the content, because of the large range of SOC contents in the samples. The influence of other parameters like soil properties is still under investigation.
Qualitative investigation of the BPCAs showed that the degree of condensation, defined by the relative amount of B6CA in the total BPCA, was higher in warmer soils. This might be explained by the fact that warmer conditions favour decomposition of organic matter and leave a higher relative amount of the most condensed and therefore also stable molecules.