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Effects of historical charcoal burning on soil landscapes in West Connecticut - Quantifying pyrogenic and organic soil carbon content of Technosols by FTIR analysis

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Relict Charcoal Hearths (RCHs) are small anthropogenic landforms that are typically found in forested areas close to historical iron works and other charcoal consuming industries. In these regions, wood was commonly converted to charcoal in upright standing hearths. Today RCH sites are still visible as either circular, button-shaped elevations (in flatland) or elliptical platforms (on slopes) in the landscape and on LIDAR based shaded relief maps. The sites are characterized by a high content of charcoal in the remaining substrate. Soils on RCHs can be classified as Spolic Technosols according to the WRB.

The recent discovery of several thousand RCHs in the North German Lowland, combined with high-resolution Digital Elevation Models, have increased awareness that historical production may significantly contribute to Late Holocene landscape change. Large-scale charcoal production also took place across several regions of the North-eastern United States. Historically, Litchfield County, in Connecticut USA, was the location of the Salisbury Iron District, known nationally for production of quality pig iron and derivative iron products manufactured at nearby foundries and blacksmith shops. Recently, a SRM analysis has revealed more than 20.000 RCHs in a 1170 km^2 area in Litchfield County in North-western Connecticut.

In this study, we present first results from the quantification of pyrogenic (Cpyr) and organic carbon (Corg) stocks of RCH soils by FTIR analysis. Based on chemometric determination of carbon contents of soil samples, we created two partial least squares regression models (PLSR) for quantifying Corg and Cpyr on RCHs and natural forest soils by diffuse reflectance infrared spectroscopy (DRIFT). In total, 79 RCHs in Litchfield County were sampled for this study. Soil samples were taken from three different locations of each RCH platform. High resolution vertical soil sampling (5 cm steps) allowed the analysis of different soil horizons/layers within an RCH profile. This study provides evidence that RCH soils contain distinctly higher contents of pyrogenic and organic carbon than adjacent reference soils and further define the distribution of substrate layers rich in organic and pyrogenic carbon within RCH stratigraphy.