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Calibrating a method for simulated long-term ageing of biochar

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We recently established a procedure that imposes oxidatiave ageing to biochar and charcoal samples over a short time-frame, that provided carbon mass loss in the range projected for wild-fire charcoal in soil over a period of approximately 100 years. The stability of biochar samples in soil (relative to charcoal) range from 45-98% could be determined repeatably with high precision.

Initial tests to understand the kinetics of the accelerated ageing method showed progressive increase in surface O concentration when examined by X-ray photoelectron spectroscopy (XPS) that slowly reached equilibrium. These trends resembled patterns observed in climate-for-time studies elsewhere, on centennial time-frame.

We have extended this work to a preliminary direct calibration by matching progressive oxidation achieved in the laboratory to the surface composition of charcoal fragments recovered from the environment after periods of hundred to thousands of years. We have also applied artificial ageing to the same sets of naturally pre-aged charcoal fragments, and to recreated fresh charcoal.

In this presentation of the first approach to quantifiably relate a laboratory test for biochar carbon stability to field data covering multiple time scales, we report on both the process and the implications for the stability of carbon stored in biochar under different climates and diverse agro-ecosystems.