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Carbon losses from soils across England and Wales

G.J.D. Kirk (1), P.H. Bellamy (1), P.J. Loveland (1), R.I. Bradley (1), R.M. Lark (2)

(1) National Soil Resources Institute, Cranfield University, Silsoe, MK45 4DT, UK, (2) Rothamsted Research, Harpenden, AL5 2JQ, UK (g.kirk@cranfield.ac.uk / Phone: +44-1525-863294)

In our recent analysis of the two samplings of the National Soil Inventory of England and Wales (NSI), made between 1978 and 2003, we have found losses of soil carbon on an enormous scale (Bellamy et al. 2005. Nature 437: 245-248). The losses occurred across all forms of land use, which suggests a link to climate change. The NSI was first sampled in 1978-83 on a 5-km grid over the whole area. This yielded about 6,000 sites of which 5,662 could be sampled for soil. Roughly 40% of the sites were re-sampled at intervals from 12 to 25 years after the original sampling – in 1994/96 for agricultural land and in 2002/03 for non-agricultural. Exactly the same sampling and analytical protocols were used in the two samplings. The results showed that over the survey period soil carbon was lost at a mean rate of 0.6 g per kg per year. There was a linear relation between the rate of loss per unit mass of soil and the soil carbon content, and the relation held across both countries and across all forms of land use – arable, permanent grassland, rough grazing, woodland, etc. Various changes in land use and management will have contributed to the carbon losses. However the occurrence of losses across all categories of land use, and the consistency of the linear relation between rate of loss and soil carbon content across land uses, suggests a link to climate change. Climate change is expected to increase the rate of turnover of soil carbon and hence losses, both as a result of increasing temperature and changes in soil moisture with changes in rainfall distribution. It has been predicted that the resulting increased release of carbon dioxide would in the future exceed increased carbon capture in vegetation with faster growth under greater atmospheric carbon dioxide levels. Our results suggest this is happening already in England and Wales. Much of the soil carbon stock of England and Wales is in wet, humose soils, and carbon turnover in such soils is sensitive to changes in seasonal rainfall distribution and temperature. However current models of soil carbon turnover do not capture such effects reliably.