First proof that the clock is ticking on British farm soils

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Soil at Rufford Forest Farm. The dark top layer is a rich, fertile organic layer, and the orange layer underneath is less fertile and contains more red sandstone. Credit: Lancaster University

Research into a UK arable farm has indicated that the soil could be eroded to the point of bedrock exposure within two centuries.

A study of an arable farm in Nottinghamshire found that—under the current management regime—the topsoil could be eroded in 138 years with bedrock exposure occurring in 212 years.

This work is one of the first in the world to measure the rates at which soils form in arable settings where soil erosion is also known. It provides the first quantitative estimate of soil lifespans and shows that soil erosion—accelerated by agricultural activities—is clearly happening at a faster rate than soil can be formed.

Researchers used a drilling rig to extract a core of soil and bedrock. A series of experiments enabled them to work out how fast soils form on this site. These rates were then compared with the rates of soil erosion.

Until now, there has been no measurement of soil formation and soil erosion in parallel on soils which are currently supporting agriculture.

Researchers say—although this time scale is longer than previous estimates- it is the first clear scientific estimate of soil lifespans which gives farmers and policy makers a more accurate idea of the sustainability of our soil resources.

Rufford Forest Farm. Credit: Dan Evans

Given that soil erosion was found to be exceeding soil formation by more than two orders of magnitude, they also say it highlights the need for changes in land management practices to curb erosion and preserve soils for future generations.

Dan Evans, the lead author of the study, said: "We have known for a long time that water, wind and tillage erosion are moving soil downslope, but haven't been able to quantify the rate at which arable soil forms. Here we have been able to show that soil formation rates are in the order of a few 1/100s of a millimetre per year which is much lower than the erosion rates measured at the same site."

The researchers warned that things could be worse than their projection indicated as their experiment site had soil depths of around two meters but in other parts of the world topsoil may have already thinned after a century or more of intensive agriculture, truncating its potential future lifespan.

Dr. Andrew Tye of the British Geological Survey, one of the partners in the project, said: "In some of the most degraded landscapes, soils are often less than half a meter thick and this has serious implications for the length of time these soils are expected to exist, remain productive and deliver vital ecosystem services.

"200 years may seem like a long time, however, as the demands on soils intensify with the growth of the world population, land management regimes need to adapt to stop the thinning of soils and promote the

improved soil heath."

Professor John Quinton of Lancaster University added: "With the theme of this year's world soil day being 'stop soil erosion' this research could not be more pertinent. We need to recognize the importance of soils for our future food production and act now to protect and enhance them for future generations."

More information: Daniel L. Evans et al. Arable soil formation and erosion: a hillslope-based cosmogenic nuclide study in the United Kingdom, *SOIL* (2019). DOI: 10.5194/soil-5-253-2019

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