



## **Landscape scale estimation of soil carbon stock in three-dimensions for creating a carbon loss risk map**

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Mapping the availability of soil carbon (C) is very important for assessing soil quality. In preparation to the consequences of climate change we need to be able to precisely predict the risk of C losses in order to avoid soil degradation and loss in fertility. However, at the moment in England and Wales we can rely only on average topsoil values of C stock. Considering that the amount of soil C normally increases exponentially in the topsoil there is a need to obtain high resolution estimates in order to accurately assess the C losses risk.

For this reason we applied a novel method based on depth functions to precisely predict soil C stock in 3D obtaining a very high vertical resolution map. The results show that this method is able to estimate with an acceptable level of accuracy both soil C and bulk density over an area of approximately 13000 Km<sup>2</sup> in the West Midlands region and with a vertical resolution of 10 cm.

From these estimates we computed the erosion risk using the well-known Universal Soil Loss Equation. We then correct the erosion prediction with the amount of C. We also considered the percentage of C available in soil in order to compute the risk of fertility losses. We conclude that the study area is at a very high risk of C losses. The Welsh border presents an high risk of losses by erosion due to the particular morphology and the high silt content. On the other hand the valleys around Birmingham, even though they present a relatively low erosion risk, the available C is below the 2% threshold meaning that the risk of soil degradation and loss of fertility is extremely high.