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The development of testing apparatus to measure carbon losses in soils

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Soil is the largest terrestrial store of carbon in the world. It is estimated that soil contains approximately 2344 Gt of organic carbon globally [6]. Organic carbon is mainly sequestered in soils through plants [4], however, carbon can also be lost as a result of inappropriate land management, although other factors such as temperature and precipitation are also influential [7]. There have been efforts to monitor carbon losses from soil using soil reflectance [3], spatial and temporal data, [7], as well as more traditional method like sampling from controlled plots [1] although there is still a lack of understanding of the magnitude of carbon losses in soils and the mechanisms which drive organic carbon losses. This study will attempt to quantify organic carbon losses through dissolution and local erosion with the use of a newly developed testing apparatus. The schematic of the testing apparatus is shown in Figure 1.

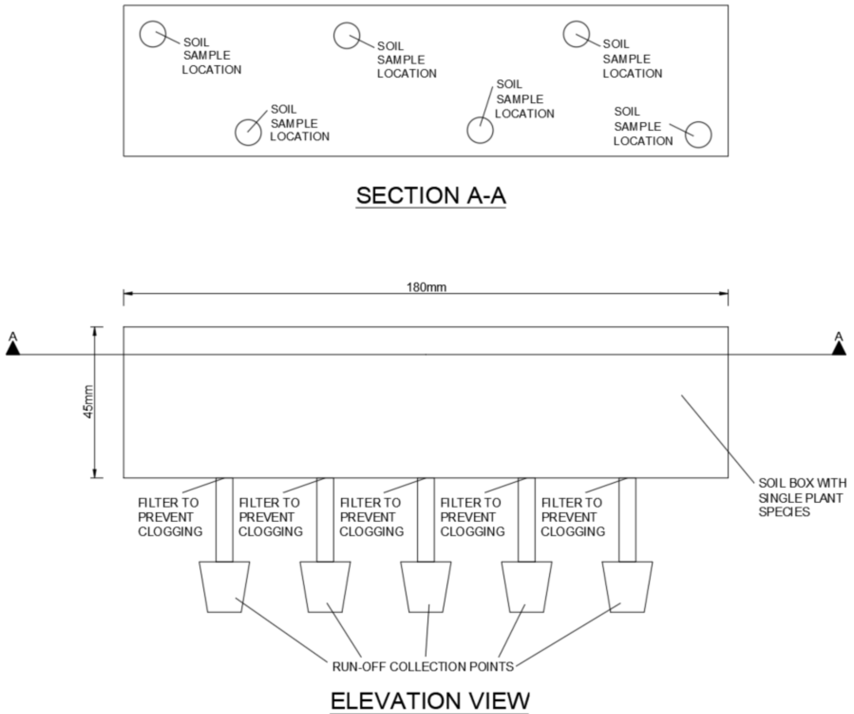

Figure 1: Schematic of proposed testing apparatus to quantify carbon losses in soils through natural processes.

The testing apparatus will be stored in an outdoor location which ensure field conditions are captured and prevents any influence of laboratory atmospheric conditions. This project will develop a sampling strategy which will include regular testing to monitor overall changes on soil organic carbon using a number of plots with different plant species since plant species play a significant role through their root activity which determines the elevation of CO_2 in soil [5]. The sampling strategy includes samples taken from each location shown in Section A-A in Figure 1. Soil samples are tested for bulk density, pH and total organic carbon through loss

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on ignition testing as well as other soil physical properties such as particle size distribution and permeability. Regular sampling and testing for soil physical properties will allow for correlations between a soil's physical state and organic carbon losses to be determined. There is also some evidence that levels of organic carbon (and hence organic matter) can influence geotechnical properties of soils [2]. The sampling strategy also includes water samples taken from each run-off collection point as shown in Figure 1. Additional sampling will be undertaken following any periods of significant rainfall.

The results from this study will be used in conjunction with field work in order to better understand the mechanisms which drive organic carbon loss in soil and hence provide recommendations on approaches to prevent carbon loss. Monitoring of chosen location over time to quantify carbon losses using a combination of sampling and testing and using Earth Observation data, similar to previous approaches taken in previous studies [8].

Contributor statement

Andrew Minto: conceptualisation, methodology, writing – original draft.
M. Ehsan Jorat: supervision, writing – reviewing and editing.

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