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The influence of soil crusting on carbon dioxide emissions from soil

Elizabeth Armstrong (1), John Quinton (2), and Nikolaus Kuhn (3)

(1) Lancaster Environment Center, Lancaster University, Lancaster, UK, (2) Lancaster Environment Center, Lancaster University, Lancaster, UK, (3) Department of Environmental Sciences, Basel University, Basel, Switzerland

Global soils contain an estimated 1500GT of carbon, over twice that present in the atmosphere, however the role of soil in the global carbon cycle is highly debated. The influence of soil erosion and deposition in the global carbon cycle has been primarily investigated through the incubation of small volumes of loose sediment. The physical properties of this sediment are likely to differ to those in the environment where in situ soil forms part of an intact unit which can have a cohesive high density crust at the surface. The primary aim of this investigation was to measure carbon dioxide emissions from intact crusted soil samples. Rainfall simulation was used to create areas of soil crusting under high and low rainfall intensity in areas of erosion and deposition. The carbon dioxide emissions were measured over a 58 day period using an Infra Red Gas Analyser (IRGA). Physical properties of the crusts (total C content, C:N ratio, texture, density, degree of aggregation) were also determined. It was found that CO2 emissions were not related to C content alone, with strong correlation found to density (rs – 0.70) and aggregation (rs – 0.67), and texture also being influential although to a lesser extent. It is the effect that these properties have on OM bioavailability and gas diffusivity which affects the emissions of carbon dioxide. The physical properties of a crust are influenced by rainfall intensity, a conceptual diagram explaining this process has been developed. Given the strong correlation that has been found between carbon dioxide emissions and the physical properties of soils to base estimates of emissions on studies of loose samples maybe flawed. Furthermore given that rainfall intensity is predicted to change with global warming so to may soil crusting and emissions of carbon dioxide.