Geophysical Research Abstracts,
Vol. 11, EGU2009-729, 2009
EGU General Assembly 2009

Relationship between caesium-137 and soil organic carbon (SOC) in cultivated and uncultivated/grazing landscapes

C. Martinez (1), G.R. Hancock (1), and J.D. Kalma (2)

(1) The University of Newcastle, School of Environmental and Life Sciences, Callaghan, Australia (cristina.martinez@studentmail.newcastle.edu.au), (2) The University of Newcastle, School of Engineering, Callaghan, Australia

The soil carbon pool is a key element within the global carbon cycle. Almost twice the size of the atmospheric carbon pool, and approximately three times that of all living things (biosphere), the soil carbon pool is a significant sink or reservoir for organic carbon. The impact of soil redistribution processes (i.e. soil erosion and deposition) on the movement, storage and loss of soil organic carbon (SOC) has become a subject of debate amongst the scientific community. One school of thought claims soil erosion promotes the storage or sequestration of C (i.e. erosion is a net atmospheric C sink), while others suggest that soil erosion leads to the removal of SOC from the landscape through reduced productivity and soil degradation (i.e. erosion is a net atmospheric C source).

Recently, studies have investigated the effects of soil redistribution on SOC using the caesium-137 (137Cs) radio-isotope method. The 137Cs method provides an opportunity to trace the fate of soil (and SOC) in a spatially distributed fashion. Strong and statistically significant relationships between SOC and 137Cs have been observed in heavily cultivated (i.e. highly disturbed) landscapes. These findings have lead to a number of common conclusions, namely that 137Cs and SOC are moving by the same physical processes and the same physical pathways, leading to the possibility of using 137Cs as tool by which to determine SOC distribution patterns. While the literature regarding the relationship between SOC and 137Cs within highly disturbed, cultivated landscapes appears to be reasonably established, there has been a dearth of studies in uncultivated (i.e. largely undisturbed) environments.

In this study, we use the 137Cs method to quantify soil redistribution patterns (vertical and lateral) and examine the relationship with SOC for a 150ha catchment in the Upper Hunter region of New South Wales, Australia. The study site has a number of areas which are subject to different land use histories (cropping and pasture/grazing) and characterized by different soil types. Therefore, it offers a unique opportunity to investigate the relationship between 137Cs and SOC for both cultivated and uncultivated landscapes, and thus examine whether the relationship applies to a range of environments.

Results indicate that the distribution of 137Cs and SOC with depth in the soil profile differed among land use and soil types. Grazing areas of the catchment had the lowest rates of soil erosion and marginally higher SOC levels than areas formerly under cropping. The relationship between 137Cs and SOC was also investigated, with results indicating that there was no relationship between 137Cs and SOC for uncultivated hillslopes. In contrast, strong and statistically significant relationships were found for the previously cropped transects. The results of this study suggest the use of 137Cs data to predict SOC redistribution patterns in grazing, largely undisturbed landscapes is problematic. More research is therefore required to further investigate the impact of soil redistribution patterns on the movement, storage and loss of SOC under a range of land use and management practices, and different environments.