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Distribution and significance of dissolved organic carbon under three land-use systems, NSW, Australia

Rubeca Fancy (1), Brian R Wilson (1,2), Heiko Daniel (1), and Yui Osanai (1)

(1) University of New England, Armidale NSW 2351, Australia, (2) NSW Office of Environment and Heritage, Armidale NSW 2351, Australia

Carbon accumulation in surface soils is well documented but very little is known about the mechanisms and processes that result in carbon accumulation and long-term storage in the deeper soil profile. Understanding soil carbon storage and distribution mechanisms is critical to evaluate the sequestration potential of the soils of different land uses. Recent investigations have demonstrated that the movement of dissolved organic carbon (DOC) in the soil profile could contribute significantly to the carbon balance of terrestrial ecosystems. However, very little is known regarding the importance of DOC to vertical distribution of soil organic carbon (SOC) pool through the soil profile in different land-use systems, management practices and conditions prevalent in Australia. We investigated the quantity and distribution of SOC and DOC through the profile under three different land-use systems in northern NSW, Australia. A series of site clusters containing a representative range of land-uses (cultivated, improved pasture and woodland) were selected across the region. Within each land use, we determined SOC and DOC concentration and quantity down the soil profile to a depth of 0-100 cm using six soil depth increments. Here we discuss the distribution and relative importance of DOC down the soil profile to the storage and distribution of carbon. We compare and contrast the patterns associated with the different land use systems and explore potential mechanisms of carbon cycling in these soils. Near to the soil surface, SOC had larger concentrations in the order woodland>improved pasture>cropping at all sites studied. However, DOC was found in significantly larger concentrations in the woodland soils at all soil depths. The larger DOC:TOC ratio in woodland and improved pasture soils suggests a direct relationship between TOC and DOC but increased DOC:TOC ratio in deeper soil layers suggests an increasing importance of DOC in soil carbon cycling in these deeper soils under Australian conditions.