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Predicting profile carbon distribution in contrasting land-uses and soil types in NW New South Wales, Australia.

Brian Wilson (1) and Christine Walela (2)

(1) NSW Department of Environment, Climate Change and Water, Armidale, NSW 2350, Australia, (2) School of Environmental and Rural Sciences, University of New England, Armidale, NSW 2351, Australia

Accurate quantification and estimation of soil carbon through the soil profile is of growing importance for carbon accounting and to evaluate the significance of soil carbon storage for the mitigation of greenhouse gas emissions. Strong evidence exists to suggest that the concentration and quantity of carbon in surface soils changes significantly in response to land-use pressure. In Australia however, little is known about the distribution and response of subsoil carbon under different management regimes. Here we sought to characterise and predict profile soil carbon distribution under a range of land-uses and soil types across diverse landscapes of northwest New South Wales (NSW). The conventional approach to describe and predict soil carbon distribution in Australian soils is the use of single, negative exponential functions. However, we determined that double negative exponential functions provided a much more accurate representation of these distributions to depth across the soils and land-uses that we studied. Here we report on the development of suitable distribution functions using a series of "type" profiles across ten soil types in the Border Rivers Gwydir catchment of northwest NSW. Theoretical functions derived from these sites were then tested against a more spatially extensive validation dataset derived from the NSW Statewide Soil Monitoring Program. We demonstrate that by modifying a small number of key parameters related to climate, soil type and land-use, we can refine and improve fit to provide more accurate carbon distribution predictions. We demonstrate the suitability and accuracy of our depth distribution model and its use as a basis for carbon density prediction across broad areas of NSW.