Change in soil organic carbon stocks under twelve climate change projections over NSW, Australia

Mr Jonathan Gray[1,2], Associate Professor Thomas Bishop[2]
[1]NSW Office of Environment and Heritage, [2]Faculty of Agriculture and Environment, University of Sydney

Digital soil mapping (DSM) techniques involving Cubist decision trees in combination with a space-for-time substitution (SFTS) process were used to map and examine changes in soil organic carbon (SOC) due to projected climate change over NSW until approximately 2070. Mapping was carried out over two broad depth intervals (0-30 and 30-100 cm) at 100 m resolution. Twelve climate change projections were applied, derived from four global climate models downscaled with three regional climate models.
Considerable variation in both direction and magnitude of SOC change was demonstrated with application of the different climate projections, with some models predicting an increase while others predicted a decrease. State-wide predictions for the upper depth interval ranged between 2.9 t/ha gain and 8.7 t/ha SOC loss. It is evident that greater consistency between climate change projections is required before we can confidently predict future changes of SOC and other soil properties.
Broad trends in SOC change were however revealed using averaged results from the twelve climate projections. A mean overall decline of 2.0 t/ha SOC across NSW for the upper depth is predicted. Although changes are primarily controlled by the balance between changing temperatures and rainfall, the extent of change is also dependent on the precise environmental regime, with differing changes demonstrated over 36 current climate-parent material-land use combinations. For example, the projected mean decline of SOC over the upper depth is less than 1 t/ha for dry-highly siliceous-cropping regimes but over 15 t/ha for wet-mafic-native vegetation regimes. DSM-SFTS techniques offer a viable alternative approach to dynamic simulation techniques to predict and identify patterns in the change of soil properties due to climate change.