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Drivers of organic carbon stock of agricultural soils in eastern Australia

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Assessing the factors that control carbon storage is the key to formulating conservation policies and sustainable soil management under changing environments. Here, we evaluate the major drivers of soil organic carbon storage in eastern Australia. To do this, we used a regional dataset including 1482 sites and targeting key land uses and soil management practices on major soils of New South Wales (NSW), Queensland (QLD) and Victoria (VIC). Structural equation modeling (SEM) and conditional inference tree (CTREE) analyses were performed to evaluate the relative importance of climate, topography, soil properties, land use and soil management practices on soil organic carbon stocks in 0-30 cm. The results showed that aridity, the most important factor controlling carbon storage, had a strong negative ($r = -0.82$, $p<0.01$), whereas clay content had a strong positive ($r = 0.42$, $p<0.01$) relationship with soil carbon stock. Only a small portion (<1%) of total variation in carbon stock could be explained by land use. The results of CTREE analysis showed that pastures, and pasture dominant crop-pasture rotations had positive influence on soil carbon stocks. The CTREE results also indicated that aridity regulates the amount of carbon present in the soil under different land uses. Using a novel multivariate technique the current work identified that aridity and clay content of soil are the main drivers of carbon storage at a regional scale over others factors such as land uses and soil management practices.