

Avoided loss of soil carbon; the role of grazing management in the semi-arid rangelands, Australia

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The extensive area that the rangelands occupy means that even small increases in organic carbon (OC) accumulation in soil may offer considerable climate mitigation potential. Agriculture in the semi-arid rangelands largely involves extensive grazing of unimproved native pastures. Given that achieving OC accumulation in soil requires that the supply of organic matter (OM) is greater than the loss through OM decomposition and erosion, grazing management that increases perennial grass cover is likely to increase soil OC. This study compared the influence of grazing management on soil OC stocks in the semi-arid rangelands, Australia. A field survey was conducted at three locations, with paired sites of long-term (>8 year) rotational grazing management and continuously grazed pastures. At each location, soil measurements included: total OC, OC fractions and total nitrogen, and site factors included: groundcover, woody vegetation and dung. Our data demonstrated that managing grazing intensity increased OC stocks in some parts of the landscape, but not all. Increased OC stocks were associated with increased ground cover; litter and perennial grass ($P < 0.01$) and proximity to trees ($P < 0.001$). We propose that increasing ground cover in this environment: i) increased in situ plant contributions of OM to soil, ii) increased the accumulation of OM being redistributed locally through water erosion and iii) protected OM in soil from loss by wind and water erosion. Organic matter is preferentially removed from soil during erosion due to its low density and this primarily occurs at the soil surface in this environment where the concentration of OC is greatest. Currently in Australia, the avoided emission of greenhouse gases attributable to clearing vegetation is eligible for carbon credits (Carbon Credit Act 2011). This research highlights the potential to incentivise the avoided loss of soil OC through grazing management that increases ground cover in the rangelands.