Soil properties and grazing management: balancing agriculture and conservation in Australian temperate woodland ecosystems

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Considerable debate exists regarding appropriate grazing management regimes to encourage biodiversity and reduce existing ecosystem degradation, while also maintaining agricultural productivity. This issue is highly relevant for the management of Box-Gum Grassy Woodlands (BGGW) in temperate regions of Australia, ecosystems which are now critically endangered due to extensive vegetation clearing, biodiversity loss and soil degradation dating back to the introduction of European agricultural practices.
This research investigates the impacts of livestock grazing upon soil properties within a landscape scale study of BGGW. Total soil nitrogen (N), phosphorus (P) carbon (C) and bulk density were sampled at 65 woodland sites with a history of either continuous, strategic or rotational livestock grazing, as well as livestock grazing exclusion. We evaluated the influence of both historical and current management practices upon soil properties in the context of broad-scale soil forming factors such as climate, geology and landscape position.
Soil parent material showed a strong influence on total soil P and N, while total soil P was also influenced by native tree cover. All nutrients measured were influenced by the combined effects of pasture type and long term fertilizer history (>10 years prior to sampling). No significant differences in soil nutrients or bulk density were detected between the different grazing treatments, likely due to the level of environmental variation between sites. However, total soil P and C increased significantly in soils sampled in the season following a grazing event, irrespective of grazing intensity or duration. Total soil N showed a similar trend. This is likely a result of multiple processes such as direct input of organic matter to the soil, stimulation of soil microbial communities and vertical cycling of nutrients between trophic levels. These findings have important implications for the strategic management of woodland understorey vegetation, as soil nutrients have been identified as important drivers of native plant diversity.