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Optimising stocking rate and grazing management to enhance environmental and production outcomes for native temperate grasslands

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Stocking rate and grazing management can be altered to enhance the sustainable production of grasslands but the relative influence of each has not often been determined for native temperate grasslands. Grazing management can range from seasonal rests through to intensive rotational grazing involving $>$30 paddocks. In large scale grazing, it can be difficult to segregate the influence of grazing pressure from the timing of utilisation. Moreover, relative grazing pressure can change between years as seasonal conditions influence grassland production compared to the relative constant requirements of animals. This paper reports on two studies in temperate native grasslands of northern China and south eastern Australia that examined stocking rate and regionally relevant grazing management strategies.

In China, the grazing experiment involved combinations of a rest, moderate or heavy grazing pressure of sheep in spring, then moderate or heavy grazing in summer and autumn. Moderate grazing pressure at 50% of the current district average, resulted in the better balance between maintaining productive and diverse grasslands, a profitable livestock system, and mitigation of greenhouse gases through increased soil carbon, methane uptake by the soil, and efficient methane emissions per unit of weight gain. Spring rests best maintained a desirable grassland composition, but had few other benefits and reduced livestock productivity due to lower feed quality from grazing later in the season.

In Australia, the grazing experiment compared continuous grazing to flexible 4- and 20-paddock rotational grazing systems with sheep. Stocking rates were adjusted between systems biannually based on the average herbage mass of the grassland. No treatment degraded the perennial pasture composition, but ground cover was maintained at higher levels in the 20-paddock system even though this treatment had a higher stocking rate. Overall there was little difference in livestock production (e.g. kg lamb/ha), because individual animal performance was greater for continuous grazing than higher intensity grazing systems (4-Paddock and 20-Paddock). Differences in SOC, CO_2 flux and erosion were determined by landscape position rather than grazing treatment. To remove the confounding influences of stocking rate and grazing management, the Ausfarm biophysical model, calibrated to the experimental treatments, examined the interaction between grazing management and stocking rates. Ground cover and profitability were similar between grazing systems at lower stocking rates (3 ewes per ha), but continuous grazing had higher profitability and lower ground cover above the optimum stocking rate of 4 ewes per ha.

The findings of these two studies suggest that optimising stocking rate is more important than grazing management for a sustainable and profitable grazing system. Grazing management can further enhance environmental outcomes for an optimal stocking rate, but the findings from the Chinese study particularly highlight the need to look at multiple ecosystem services, when optimising systems. The Australian study also suggests the optimum stocking rate is dependent on the intensity of grazing management. Further work is required to understand the influence of landscape on grassland production and how stocking rates and grazing management can be sustainably optimised for different landscape areas to utilise this variation more effectively.