Mapping pasture quality: Using remote sensing to address northern Australia's fodder gap

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Introduction

This study demonstrates how new remote sensing technologies can accurately measure the nutrient status (protein, nitrogen and fibre) of pastures. This is critical knowledge for livestock grazing management, especially with high rainfall variability and a changing climate. With knowledge of both the amount and nutritional quality of pasture (seasonally), graziers can adjust their property or paddock stocking rates and apply supplementation to ensure their operations are both productive and sustainable.

Methods

Field sampling took place at five commercial properties in Queensland's rangelands, covering both native and introduced grasses at different growth stages. Hyperspectral sensors were used on uncrewed aerial vehicles (UAVs) and from satellites to measure the nutrient content of various pastures. Spectral data was collected at the leaf, plant, and sward levels using both point and imaging systems in the field, laboratory, and from the air. Traditional lab methods were used to analyse the nutrient content of plant leaves and stems and trained a deep-learning neural network model. The model developed was used to predict nutrient content; predictions were then scaled from the plant level to an entire paddock using UAV and satellite imagery. In addition, free-to-access EMIT sensor data from the International Space Station were also used to make predictions over large areas.

Results

The model's predictions were considered to have good accuracy, with an average error of only two percent for crude protein (CV ~20%) and five percent for fibre content (CV ~5%). By mapping at the property and paddock scale, we were able to discuss the results with collaborators, which facilitated knowledge transfer and the collection of valuable feedback.

Discussion and conclusion

This study demonstrates the potential to efficiently and accurately map pasture productivity (through nutrient status) over vast areas using remote techniques. A key challenge we encountered was distinguishing tree canopy spectra from pasture spectra, and this area warrants future research. As more airborne and space-borne hyperspectral sensors become available, this technology has the potential to become a standard tool for large-scale pasture management, benefiting the Northern Australia grazing community. Due to livestock mobility and selection at the paddock scale, understanding the livestock nutritional impact of pasture quality variation within a paddock will also require further research.

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