

Introduction

This report presents, for the selected land parcel, the feed budgeting information for the user-specified grazing period, livestock numbers and the residual yield during the grazing period. The feed budgeting information presented in this report is recommended to be used by considering the on-ground pasture availability, adequate ground cover and feed for drought reserve. The pasture biomass (i.e. pasture standing dry matter kg DM/ha) at the beginning of the grazing period is modelled using machine learning method based on satellite imagery and other site information. The feed budgeting assessment for the grazing period is made by modelling pasture growth, detachment, amount eaten and trampled for historical years that had the same SOI phase using the GRASP model. If the property average pasture biomass at the start of the grazing period is provided by the user, it is used to reset the satellite imagery estimated pasture biomass. An indicative crude protein content map is also presented in the report which is generated using a combination of field sampled plant chemistry and remotely-sensed satellite imagery.

N.B. The information provided in this report is indicative only, due to the complex nature of modelling pasture growth. More on-ground information and assessment are required for comprehensive feed budgeting to achieve sustainable stocking management. Version 1.3. release date 7/9/2026.

General information

- Total land area: 37,369 ha
- User provided total stocking numbers in adult equivalent: **2000 AE (18.7 ha/AE)**
- Nominated grazing period is about **167 days - 15 Oct 2026 to 31 Mar 2027**
- User provided residual yield at the end of grazing period: **1000 kg/ha**
- User provided current property average pasture yield: **1400 kg/ha**

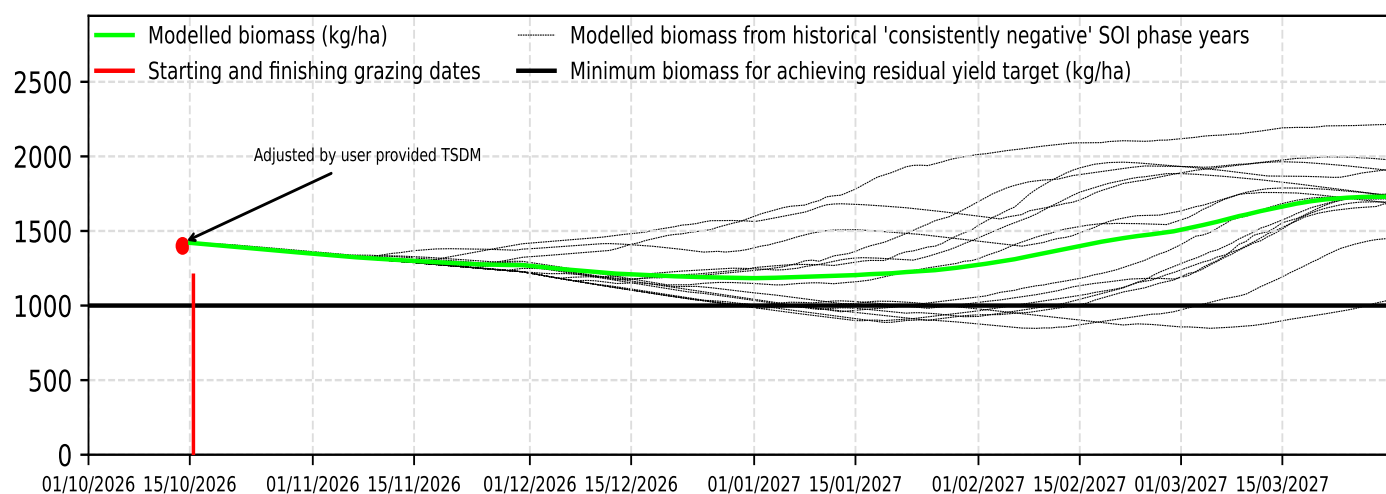
Location map



Feed budget information

- Can the pasture support grazing of 2000 AE during the whole grazing period? **Yes, likely**
- **WARNING:** the pasture utilisation rate for the nominated period will be much higher than the safe utilisation rate for the provided stock number.

Pasture biomass



How to interpret above graph

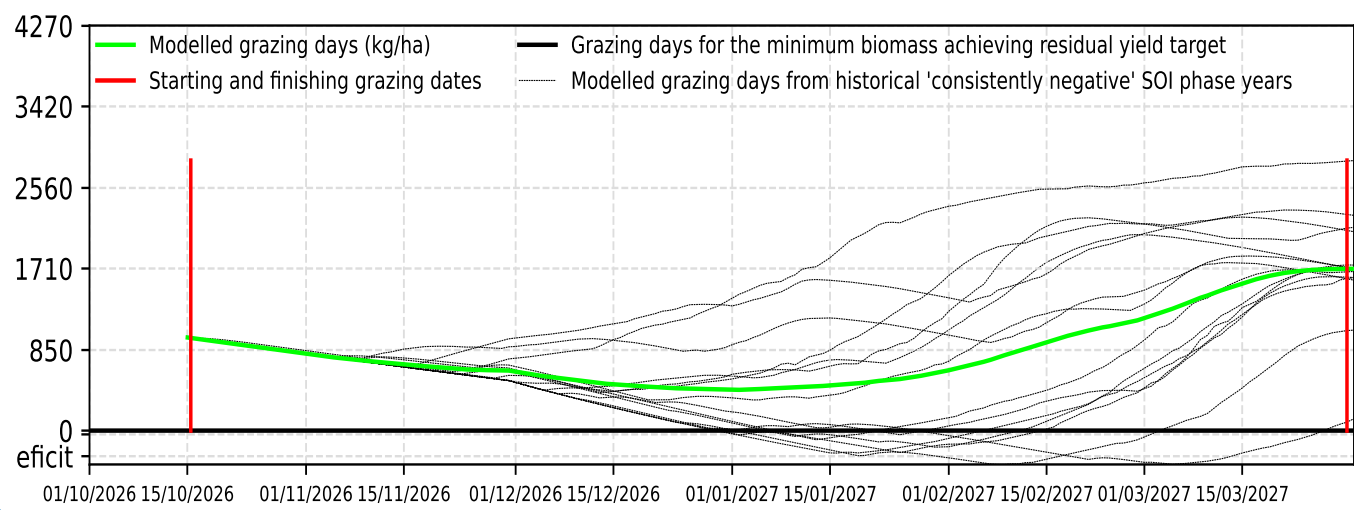
The above graph displays how the pasture biomass (green line) on the property changes during the grazing period (as indicated by the two vertical red lines). The biomass represents what exists on after taking into consideration the initial biomass, the new growth, eaten, trampled (by livestock and feral animals - from various survey sources) and detached components. Kangaroo numbers (derived from air survey data) are considered in the feed budget estimation.

The forecast of pasture growth for the grazing period is calculated using the GRASP model by considering the current pasture situation (e.g. soil moisture and nutrient factors) and the climate scenario for that location. The climate used for modelling the pasture biomass for the nominated grazing period is selected from a group of historical years with the same SOI phase (since 1960), based on the SOI phase of the month before the grazing starts. The forecasted pasture growth (green line) is the average of modelled pasture growth from all the years. The minimum residual pasture biomass (dotted line) is the feed reserve to maintain the minimum ground cover during the grazing period, which is based on 'user provided' information.

If the green line is above the dotted line for the whole proposed grazing period, it indicates that there will be sufficient feed to support the nominated stocking number for the whole grazing period. If the green line is below the dotted line for the whole grazing period, it indicates that there will not be sufficient feed to support the stocking number for the whole grazing period. If the green line is above the dotted line for some of the period, it indicates that there will only be sufficient feed to support the stocking number for those periods of times. N.B. Even if the green line is above the dotted line for the whole grazing period, it is still a possibility that there will be insufficient feed for the entire period, which is indicated when one or more of the lines moves below the dashed line.

It is a recommended best practice to use a safe pasture utilisation rate in stocking management. While an explicit 'safe utilisation rate' in the feed budget calculation is not given, if grazing commences in the Oct-Dec period, then a warning will be given when the utilisation rate exceeds the 'safe rate' (i.e. for the major land types of the area) by 10% (15% for improved pasture cases). Users are encouraged to consider this when allocating the number of livestock to prevent over-utilisation which may lead to decrease of '3P' pasture grasses.

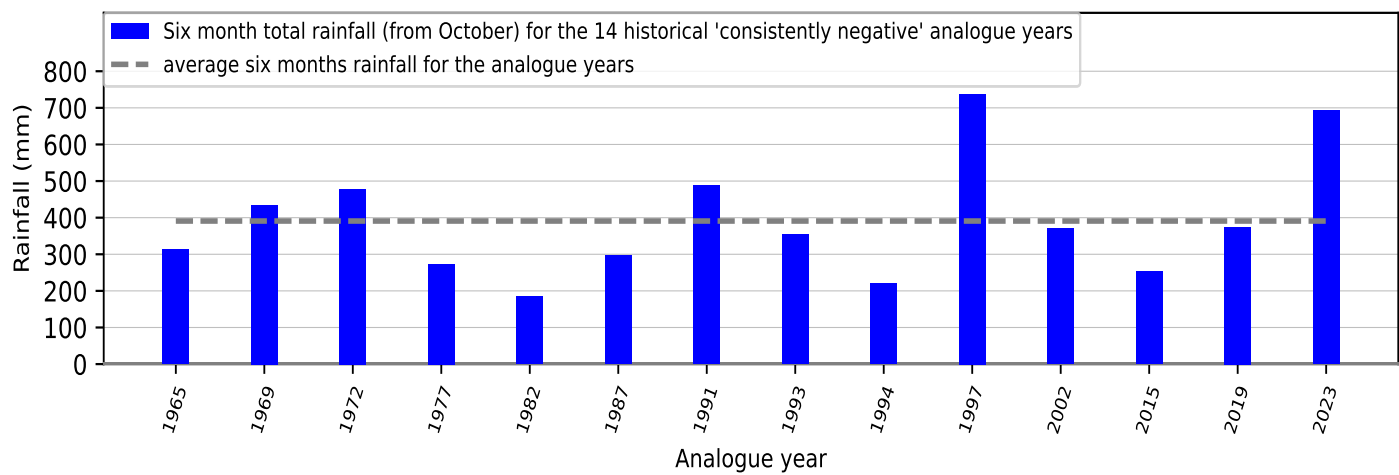
Grazing days remaining - about 168 days



How to interpret above graph

The above graph displays how many grazing days (green line) are remaining during the nominated grazing period (as indicated by the two vertical red lines) for the stock numbers provided - which is the average of the grazing days calculated, based on the historical years with the same SOI phase. The feed reserve (i.e. minimum biomass) to maintain the minimum ground cover during the grazing period (as in page 1 graph) is not used in the calculation of the grazing days.

Total rainfall in the forecasting period for years with the same SOI phase



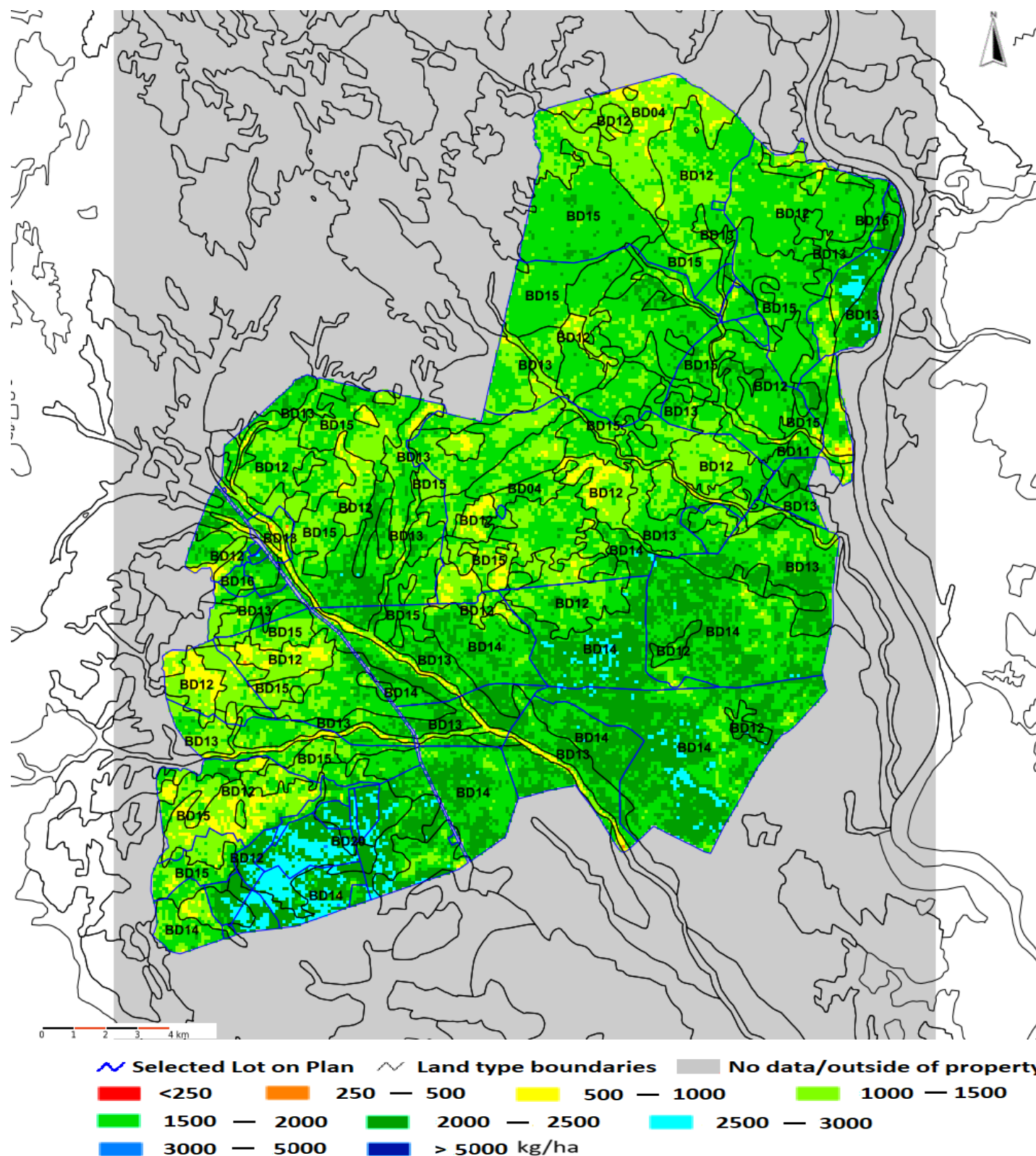
How to interpret above graph

The above graph shows the six months' total rainfall for each of the historical years with the same SOI phase from the month the grazing period started. The years are selected from 1960 onwards. The dashed line represents the average six-month total rainfall for all these years.

User provided livestock numbers

Livestock species/class	Number	Livestock species/class	Number
Adult equivalent (AE)	2000		
Total (in adult equivalent): 2000 (AE)			

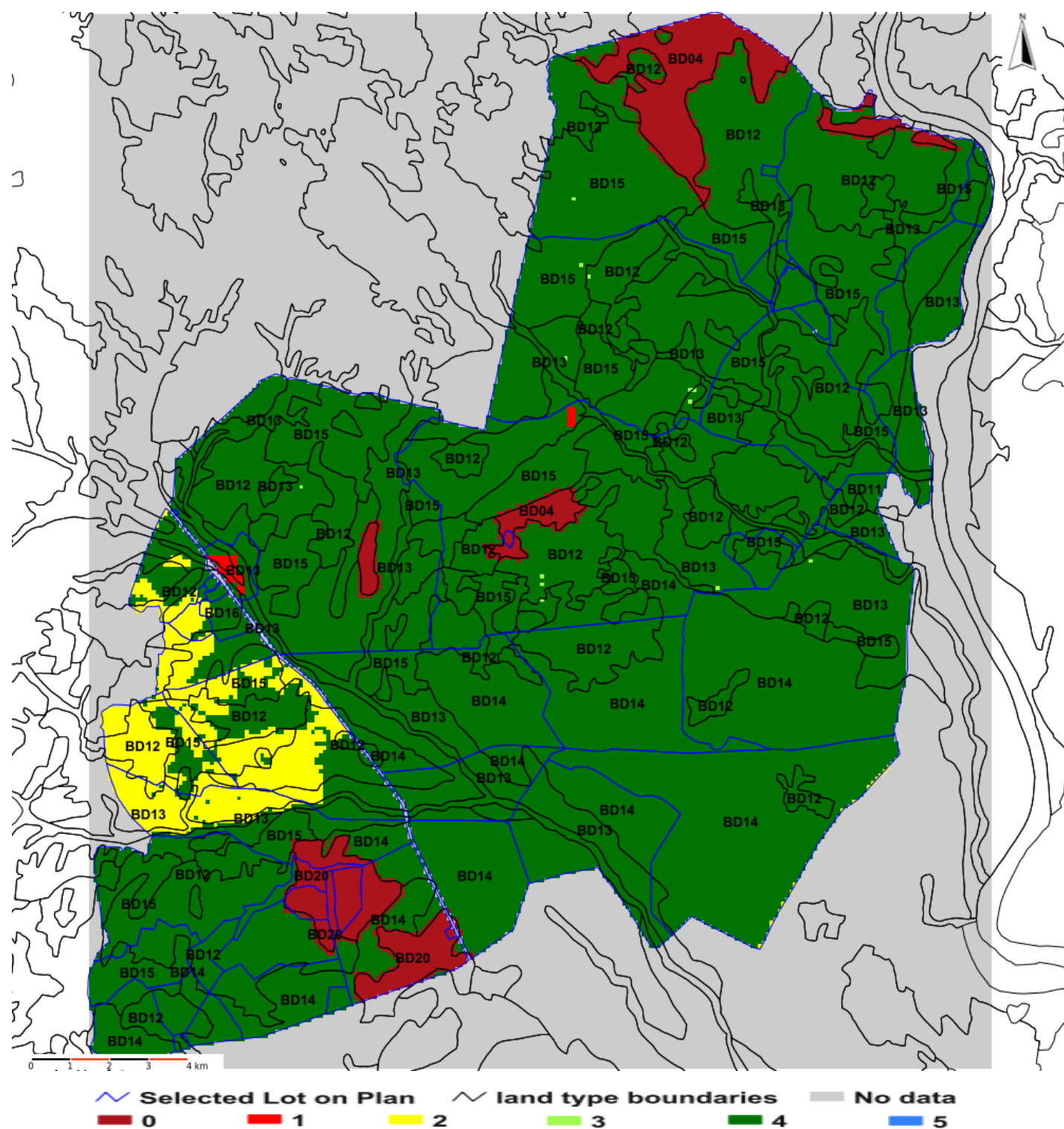
Indicative pasture biomass (dry matter kg/ha) modelled using satellite imagery as at 30 Sep 2026



About the indicative pasture biomass map

The above map was generated using a model that includes the most recent satellite imagery and other site parameters for the land parcel of interest. The model version number is model.20260818.h5.

Indicative pasture biomass model uncertainty map

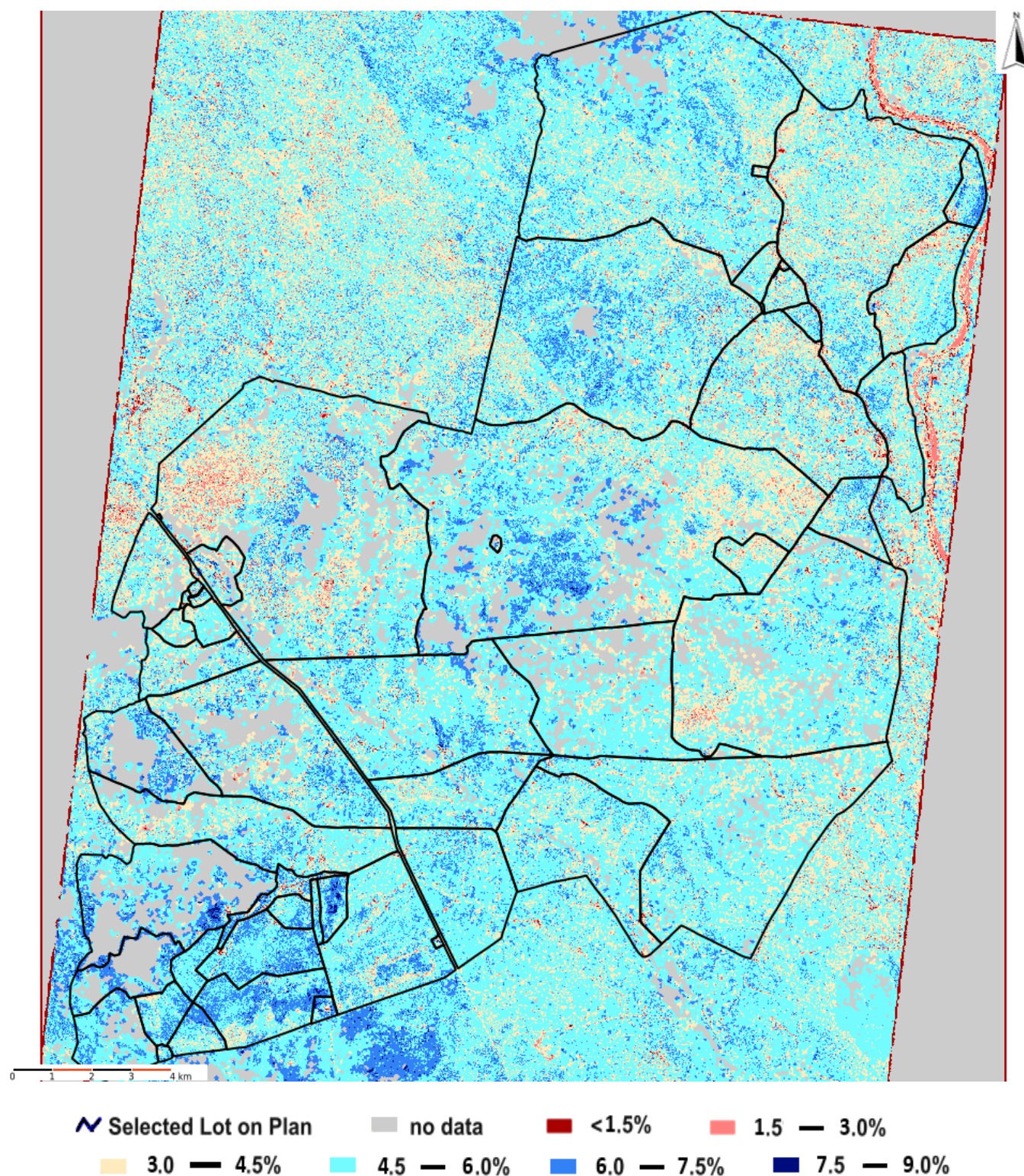


About the uncertainty map

The above map highlights areas where model predictions for pasture biomass are expected to be more or less uncertain. Confidence is classified into qualitative categories (for example, more confident, Moderate confidence, and less confident) based on conditions known to affect model performance. These categories provide a guide to the relative reliability of model outputs and are not quantitative measures of prediction accuracy.

- 0 - Extremely uncertain: uncalibrated/unvalidated due to lack of data;
- 1 - less confident: land use not plausibly grazing ;
- 2 - less confident: recent burn;
- 3 - less confident: persistent high cover causing model saturation (possibility of lawn-like system);
- 4 - moderately confident;
- 5 - more confident.

Indicative pasture crude protein content (%) as at Sep 2026



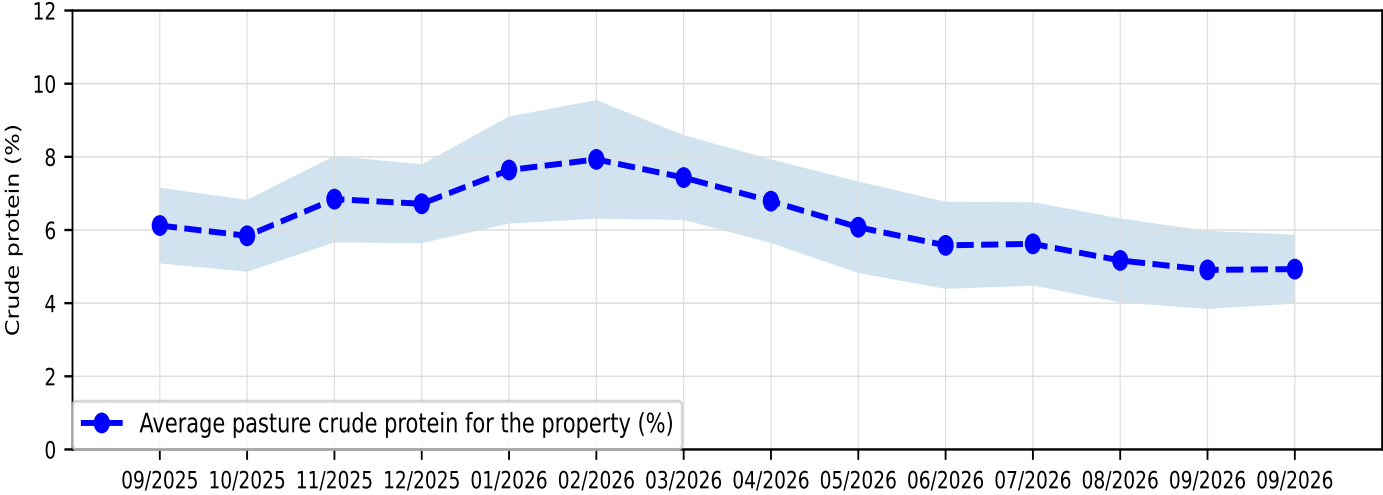
About the indicative pasture crude protein content map

This map shows the estimated crude protein content of pastures on the selected date for the property, generated using a hierarchical spectral modelling approach that combines field-sampled plant chemistry with remotely-sensed Sentinel-2 satellite imagery. A transformer-based machine learning model was developed to predict pasture crude protein content from satellite imagery. The model was trained and validated using laboratory wet chemistry analysis of plant samples collected across various pasture types and growth stages at tropical and subtropical savanna rangeland sites in Queensland, with coincidentally acquired UAV hyperspectral imagery used to scale predictions from field to satellite resolution (Barnetson et al. 2026). This map relates the estimated crude protein content of pastures on the selected date for the property, generated using a combination of field-sampled plant chemistry and remotely-sensed satellite imagery.

Please note: This map is optimised for areas with less than 22% foliage projective cover. A mask is applied to focus predictions on productive pasture areas. Isolated trees or shrubs may still lead to an overestimation of the true pasture crude protein content in those specific areas. Additionally, the model has not been calibrated for areas where frost is present, which may affect accuracy in those conditions. This data has been interpolated up to 60m for better readability.

Time series of the pasture crude protein

Time series of pasture crude protein (%)



How to interpret above graph

This graph tracks the monthly average pasture crude protein content (%) across the property over the past twelve months, revealing seasonal patterns in pasture nutritional quality. The shaded band represents spatial variability within the property (± 1 standard deviation from the mean), indicating how uniform or variable pasture quality is at any given time. Wider bands suggest greater heterogeneity across paddocks, while narrower bands indicate more consistent conditions. At pasture crude protein levels above about 2.5% animals will select higher quality intake than the pasture average crude protein levels.

To ensure accuracy, areas with foliage projective cover exceeding 22% (woody vegetation) and cloud-affected pixels have been excluded using a mask.

References

Barnetson, J., Pandeya, H. R., and Fraser, G. (2026). Hierarchical spectral modelling of pasture nutrition: From laboratory to Sentinel-2 via UAV hyperspectral. *AgriEngineering*, 8(4), 143.

Barnetson, J., Pandeya, H., and Fraser, G. (2026). Mapping pasture quality: Using remote sensing to address northern Australia’s fodder gap. In *Proceedings of the 8th Northern Beef Research Update Conference NBRUC* (p. 29). North Australia Beef Research Council. Conference presentation.

Zhang, B., Barnetson, J., Carter, J., Fraser, G., Stone, G., and Woodrow, L. (2026). Seasonal pasture budgeting at property scale: A FORAGE online tool (prototype) for assessing stocking rates for Queensland grazing lands. In *Proceedings of the 8th Northern Beef Research Update Conference NBRUC* (p. 28). North Australia Beef Research Council. Conference presentation.

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