CSIRO - Image2Biomass Prediction

Overview

Build models that predict pasture biomass from images, ground-truth measurements, and publicly available datasets. Farmers will use these models to determine when and how to graze their livestock.

Description

Farmers often walk into a paddock and ask one question: “Is there enough grass here for the herd?” It sounds simple, but the answer is anything but. Pasture biomass - the amount of feed available - shapes when animals can graze, when fields need a break, and how to keep pastures productive season after season.

Estimate incorrectly, and the land suffers; feed goes to waste, and animals struggle. Get it right and everyone wins: better animal welfare, more consistent production, and healthier soils.

Current methods make this assessment more challenging than it could be. The old-school “clip and weigh” method is accurate but slow and impossible at scale. Plate meters and capacitance meters can provide quicker readings, but are unreliable in variable conditions. Remote sensing enables broad-scale monitoring, but it still requires manual validation and can’t separate biomass by species.

This competition challenges you to bring greener solutions to the field: build a model that predicts pasture biomass from images, ground-truth measures, and publicly available datasets. You’ll work with a professionally annotated dataset covering Australian pastures across different seasons, regions, and species mixes, along with NDVI values to enhance your models.

If you succeed, you won’t just improve estimation methods. You’ll help farmers make smarter grazing choices, enable researchers to track pasture health more accurately, and drive the agriculture industry toward more sustainable and productive systems.

Evaluation and Scoring

Scoring

The model performance is evaluated using a weighted average of R^2 scores across the five output dimensions. The final score is calculated as:

$$\text{Final Score} = \sum_{i=1}^{5} (w_i \times R_i^2)$$

Where:

- The term R_i^2 represents the coefficient of determination for dimension i
- The weights w_i used are as follows:
  - `Dry_Green_g`: 0.1
  - `Dry_Dead_g`: 0.1
  - `Dry_Clover_g`: 0.1
  - `GDM_g`: 0.2
  - `Dry_Total_g`: 0.5

R^2 Calculation

For each target, the coefficient of determination R^2 is:

$$R^2 = 1 - \frac{SS_{\text{res}}}{SS_{\text{tot}}}$$

Residual Sum of Squares SS_{res}
Measures the total error of the model's predictions:

$$SS_{\text{res}} = \sum_j (y_j - \hat{y}_j)^2$$

Total Sum of Squares SS_{tot}
Measures the total variance in the data:

$$SS_{\text{tot}} = \sum_j (y_j - \bar{y})^2$$

Terms

- y_j ground-truth value for data point j
- $\hat{y}_j$: model prediction for data point j
- $\bar{y}$: mean of all ground-truth values

Submission File

Submit a CSV in **long format** with exactly two columns:

- `sample_id` : ID constructed from image ID and target_name pair.
- `target`: Your predicted biomass value (grams) for that sample_id (float).

The valid `target` names are: `Dry_Green_g`, `Dry_Dead_g`, `Dry_Clover_g`, `GDM_g`, `Dry_Total_g`.

Your file **must contain one row per (image, target) pair**, i.e., 5 rows for each image in the test set.

Header and example:

```
sample_id,target
ID1001187975__Dry_Green_g,0.0
ID1001187975__Dry_Dead_g,0.0
ID1001187975__Dry_Clover_g,0.0
ID1001187975__GDM_g,0.0
ID1001187975__Dry_Total_g,0.0
ID1001187976__Dry_Green_g,0.0
ID1001187976__Dry_Dead_g,0.0
ID1001187976__Dry_Clover_g,0.0
ID1001187976__GDM_g,0.0
ID1001187976__Dry_Total_g,0.0
```

Timeline

- **October 28, 2025** - Start Date.
- **January 21, 2026** - Entry Deadline. You must accept the competition rules before this date in order to compete.
- **January 21, 2026** - Team Merger Deadline. This is the last day participants may join or merge teams.
- **January 28, 2026** - Final Submission Deadline.

All deadlines are at 11:59 PM UTC on the corresponding day unless otherwise noted. The competition organizers reserve the right to update the contest timeline if they deem it necessary.

Code Requirements

Submissions to this competition must be made through Notebooks. In order for the "Submit" button to be active after a commit, the following conditions must be met:

- CPU Notebook <= 9 hours run-time
- GPU Notebook <= 9 hours run-time
- Internet access disabled
- Freely & publicly available external data is allowed, including pre-trained models
- Submission file must be named `submission.csv`

Please see the Code Competition FAQ for more information on how to submit. And review the code debugging doc if you are encountering submission errors.

Prizes

- 1st Place - $50,000
- 2nd Place - $20,000
- 3rd Place - $5,000

Acknowledgements

Particular thanks given to our partner the Meat & Livestock Australia (MLA) for the images provided on the competition page. MLA is the declared industry marketing body and the industry research body for the Australian red meat industry. MLA's mission is to collaborate with stakeholders to invest in research, development and marketing initiatives that contribute to producer profitability, sustainability and global competitiveness.

This work has also been supported by FrontierSI (previously known as the Cooperative Research Centre for Spatial Information)

About CSIRO

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Working with industry, government, universities and research organisations we turn big ideas into disruptive solutions. Turning science into solutions for food security and quality; clean energy and resources; health and wellbeing; resilient and valuable environments; innovative industries; and a secure Australia and region.