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Producer Research Report

Pastures from Space

South East South Australia Pastures from Space Users Group

The South East South Australia Pastures from Space Users Group intended to measure the accuracy and reliability of the Pastures from Space™ program in the south east of South Australia, and validate the date for typical pasture species in the region.

Approximately 40 paddocks, spread from Karoonda in the Murray Mallee and Kangaroo Island to Mt Gambier in the south east of South Australia and Casterton in Western Victoria, were selected as validation sites.

Based on this limited dataset, a strongest relationship between satellite-predicted and paddock-measured PGR values for annual compared to perennial pastures was demonstrated.

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The project

Henry (2002) described the potential of measuring biomass and pasture growth rate (PGR) from satellite imagery and indicated that on-farm applications of the technology include grazing management decisions, strategic fertiliser applications, diagnosing unproductive and unresponsive land, strategic farm planning and benchmarking current pasture performance against past years. The potential to more accurately budget feed and thereby improve pasture utilisation is seen as another key application.

Pastures from Space™ delivers near real-time pasture growth rate information at both a whole farm and paddock level directly to a farm computer on a weekly basis. With its associated software PastureWatch™, the program enables pasture growth rates and pasture production to be assessed from the farm office, comparisons to be made between paddocks (eg. effects of fertiliser applications and rates), and provides objective data for detailed feed budgeting and grazing planning.

The data that is provided for use with Pastures from Space has been calibrated on annual pastures in Western Australia. Anecdotal evidence from producers using the service in the south east of South Australia suggests that the data is not always accurate for this region because of different pasture species in the sward (eg. more perennials such as phalaris and fescue), and the different and variable soil types in the region (and within a farm).

This producer research support project was intended to measure the accuracy and reliability of the Pastures from Space program in the south east of South Australia, and validate the date for typical pasture species in the region.

Objectives

1. Investigate the accuracy of Pastures from Space™ data in the south east of South Australia for typical pasture species and soil types by comparing it to on-ground measurements;
2. Use this information to highlight issues to be addressed with more in-depth research; and
3. Enable a maximum of 12 farming businesses to monitor their pasture growth using Pastures from Space, learn some of the management decisions that can be made using this information, and quantify pasture utilisation on their properties.

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What was done

The project monitored 11 paddocks on four properties in the mid-south east of South Australia. Another 22 paddocks were monitored on nine further properties in a parallel project funded by Australian Wool Innovation Ltd to expand the total monitoring to 33 paddocks on 13 properties – spread from Karoonda in the Murray Mallee to Penola in the lower south east of South Australia and Casterton and Strathdownie in western Victoria. The outcomes presented in this report are based on data collected across all properties.

The breakdown of the properties, paddocks and their pasture types can be seen in *Table 1*.

Table 1. Site details for properties, paddocks and pastures types involved in the project

PIRD PROJECT			
Name	**Area**	**Paddock**	**Types**
		Annual Pasture	Perennial Pasture
Struan	Naracoorte	1 x annual grass dominant	
Stewart	Keilira	2 x annual rye dominant	2 x Perennial Rye dominant
Craig	Benayeo	2 x annual grass dominant	
Flower	Cadgee	2 x annual grass dominant	2 x Phalaris Dominant
	Total	7 paddocks	4 paddocks
AWI PROJECT			
Name	**Area**	**Paddock**	**Types**
		Annual Pasture	Perennial Pasture
Cook	Casterton		1 x Rye Dominant
			1 x Phalaris Dominant
Smith	Strathdownie		1 x Phalaris Dominant
Harvey	Strathdownie		2 x Rye Dominant
Rymill	Penola		3 x Phalaris Dominant
Hocking	Avenue Range	2 x annual grass dominant	2 x Phalaris Dominant
Schleuniger	Robe		3 x Phalaris and Fescue
Sigston	Keith	2 x annual grass dominant	1 x Lucerne
Blacket	Karoonda	2 x annual grass dominant	
Roberts	Karoonda	2 x annual grass dominant	
	Total	8 paddocks	14 paddocks
	TOTAL	15 paddocks	18 paddocks

In each paddock a straight-line transect was pegged along and/or across the major soil types. The start and end of each transect, and each major turn, was permanently peg marked and the position of each peg logged using a high accuracy GPS. Pasture cages were placed at regular distances along the same transects. Cages were moved prior to the break of the season to an area on the transects that had been grazed over summer. The initial location of each cage was permanently pegged and the position of each peg logged using a high accuracy GPS.

Pasture growth rate (PGR) measurements were conducted every 28 days and for each cage, with measurements of food on offer (FOO) made at the start and end of the growth period. At each measurement date four visual FOO readings were recorded from both inside and outside each cage and visual estimations of botanical composition as a percentage of total FOO in the whole cage were recorded (clover (C), grass (G) and other species (O)) before the cage was moved to a new location.

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After a new location was selected and the cage pegged to the ground, the measurements were repeated and recorded. The new location of the cage was within 3m of the previous location and representative of the overall pasture close to the cages. Measurements were continued on individual transects until senescence of the pastures had occurred. This was longer for some transects than others, depending on their soil and pasture type and location.

Highlighting Issues For Further Research

In April 2008, a final workshop was held to review the results of the combined projects. This workshop involved a presentation of results, followed by a discussion on the accuracy and usefulness of the data, what the producers might do with the data, how likely they were to continue to use the technology, and what (if any) were the barriers to continuing use of the technology.

Learning How To Use Pastures From Space Information

Five meetings/workshops were held. Most involved a phone or video conference link with members of the research and development team at CSIRO Livestock Industries in Perth to troubleshoot issues relating to the use of Pastures from Space information, and the Pasture Watch software. Many meetings were held in parallel with a SheepPlus group that was formed as a subset of the project group. An active producer user of the Pastures from Space technology from Western Australia was included as a guest speaker at two of the meetings.

What happened?

Accuracy Of Pastures From Space Data

Field observations were undertaken during May, June, July, August, September, October, November and December 2007 (to include weeks 41 and 45 at some sites). Average pasture growth rates from these observations were derived from grazing exclusion cages (7-10 per paddock) located along straight-line transects across the paddock. The data was compared to PGR model predictions based on satellite-derived normalised difference vegetation index (NDVI) data. PGR model predictions included an adjustment for soil type (model soil adjusted) in each of the paddocks.

The results presented are those for the average field observed and model predicted PGR values for individual paddocks across three of the focus sites – Blacket, Hocking and Harvey. These sites provided a geographical spread of properties and included both annual and perennial pastures.

PGR observations were conducted during June, July and August for the Blacket site. The season ended abruptly and pasture senescence prevented any further measurements. The field observations and the soil adjusted model predictions of PGR were found to be similar for the two annual pasture paddocks for May and July, but the field observed PGR was higher than the model for August. The inclusion of soils information in the model did not change the PGR values for individual paddocks. A similar relationship between the field and predicted PGR was also observed for the individual paddocks at the Roberts site, which showed a consistent trend in PGR between the observed and predicted values.

PGR observations at the Hocking site were undertaken in June, July, August, September, October and November. The pastures at this site had an additional 14 weeks of growth compared to the sites at Karoonda, although the season was not typical for temperature or rainfall. For the annual and perennial paddocks, the soil adjusted model

predictions matched the field observations for June, July, August and November, however, there was a marked difference between the two measurements for September and October. The model predictions were higher than the field observations in September and lower in October. A large variation in growth rate was recorded for the individual cages in all of the paddocks, particularly for October. This may have been a function of the significantly drier than normal spring period, higher average maximum temperatures, and very shallow soils at this site.

Adjusting for soil type increased the PGR predictions in all paddocks for October. It resulted in minimal change to PGR predictions for the other four months of observations.

PGR observations were conducted at the Harvey site monthly from June to November. There was a divergence in the model predictions for the two perennial paddocks during September, October and November. Adjusting for soil type decreased PGR predictions, resulting in a greater difference between the observed and predicted values, particularly for September and October. The observed and soil adjusted model predictions tended to be similar for the other months. As for the Hocking site, there was a large variation in growth rate recorded for the individual cages in paddocks, particularly in October and November. This may have been a function of the drier than normal spring, resulting in more variation within paddocks, but is still being investigated.

In addition to the workshops, project activities and results have been extended through:

- Monthly articles in the local AgriTalk column presented by PIRSA;
- A paper and poster at the 2007 Grasslands Society of Southern Australia conference at Murray Bridge;
- A presentation at the South East Seeds information day in September 2007;
- A display at the 2008 South East Field Days at Lucindale;
- A presentation to the Lochaber Agricultural Bureau in May 2008;
- A display at the BestWool/Bestlamb FEWEture Farming conference in Bendigo in May 2008;
- A paper and poster at the International Grassland Congress in Hohhot, China; and
- An invited paper given to the 2009 Grasslands Society of Southern Australia conference at Bairnsdale, Victoria in August 2008.

Thirty producers received a weekly email with pasture growth rate data for the region in 2006 and 2007 and will receive the data again in 2008.

The project was also featured on the south east South Australia ABC Radio's Rural Report in September 2007, with the report also making it onto the ABC's South Australian Country Hour.

Discussion

Accuracy Of Pastures From Space Data

The data showed that spring 2007 was much drier and warmer than typical for the region. Despite this, the field observed PGRs at all sites tended to be slightly above the model predicted values, although the trend between the two data sets was consistent.

There were three points at which there was a marked difference between the model predictions and the field observations at nearly all sites. The model predictions were generally higher than the field observations in September, and lower in October and November. Reasons for these anomalies are not clear, however the September measurement may have been was probably influenced by a significant change in visual calibration by the technician. Anomalies in the October and November measurements may be related to the drier than normal conditions in 2007, and the model not adequately predicting growth under these conditions or soil types. It is not possible to identify which of these issues is having greatest effect as there is insufficient local climate data for comprehensive analysis.

It is therefore proposed that any future validation work include soil moisture and temperature probes at all monitoring sites to better address local climate variation from Bureau of Meteorology values. Soil depth and type would also need to be assessed and alternative methods of pasture mass assessment might be useful to reduce the measurement variation at a site (eg. GreenSeeker or other hand-held NDVI technology).

The most significant outcome is that the model predicted and field observed PGRs were equally well predicted for annual and perennial pastures. This is significant as it means that any future validation work can focus on less geographically diverse sites because it will not need to have the spread of pasture types covered by the current projects.

The greatest learning for the producers came from the two meetings where Western Australian producers already using the technology spoke to the local producers. While unsure of the benefits of Pasture Watch at the start of the project, by April 2008 at least six producers were either already subscribed or seriously considering subscription for the coming year.

The major take home messages from the WA speakers were:

- Use spreadsheets to analyse the Pastures from Space data (eg. seasonal comparisons, effects of break of season on total dry matter production, etc.) and inform strategic decision making;
- While WA data and the technology is based on at least 10 years of data, it explains about 70% of the data variation, which is accurate enough for most applications;

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- The technology allows rigorous recording of every paddock in every week; and
- The data is most relevant early in the season since this is when everything is set up and the most important strategic decisions are made.

Despite the limitations of the current accuracy of the data, the $425/year subscription cost of Pasture Watch (the commercial software and service) is a very cost effective means of obtaining rigorous recording of PGR in every paddock in every week of the year.

Next steps

The producer group agreed that more data is needed to validate and calibrate the technology for local conditions. Project funding is being sought to continue data collection on a sub-set of the properties for at least an additional year (but preferably two years). New work would consist of both group learning activities and continued data collection to complete the validation work. Linkage to other projects is also being investigated to widen the dataset and make the best use of existing monitoring. Once greater confidence in the data has been confirmed, the usefulness of the data needs to be demonstrated to a wider audience.

The project enabled 10–12 farming businesses to learn about the management decisions that can be made using this information. The group was adamant that they wanted to continue to meet to discuss progress with the technology, their own experiences with the data, share stories of success (and frustration) with the technology and to continue to learn how to use the data.

Others indicated that now they have had training in the use of the Pastures from Space PGR data they are keen to make use of the data for their own farm management decisions, especially if more group learning/activities can be organised to help them as they proceed.

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