PASTURES FROM SPACE – VALIDATION OF PREDICTIONS OF PASTURE GROWTH RATES

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To improve the sustainability of Australian agriculture, new technologies are needed to monitor and assist management decisions in grazing systems. Pasture growth rate (PGR) is a critical driver, however few farmers can find the time and resources to assess PGR on all farm paddocks. A deterministic model to estimate PGR in a GIS environment has been developed by the Pastures from Space consortium (Mata *et al*. 2004). This paper reports the validation of the model using actual PGR, and following improvement to satellite imagery.

To estimate PGR, current weekly spatial climatic surfaces were integrated with satellite information (Edirisinghe *et al*. 2000). Prediction required timely and frequent access to these data sets; the Department of Land Information has provided NOAA AVHRR satellite time series data since 1994, and from early 2002, TERRA satellite MODIS in the form of bimonthly composited normalised difference vegetation index (NDVI). The TERRA MODIS sensor delivered information to the PGR model with a pixel size of 250 m^2, a significant improvement over the NOAA AVHRR sensor pixel at 1100 m^2. Both these sensors provided a NDVI to estimate absorbed photosynthetic radiation in the PGR model.

The dynamics of PGR responses in the high winter rainfall annual pasture region of southern Australia reflect a characteristic growth pattern showing a substantial increase in growth in late spring. This relationship between NDVI and PGR provides the fundamental basis for estimating PGR remotely. The estimate is improved by including local climatic information. Field PGR was recorded by setting exclosure cages at regular intervals across a number of farm paddocks. The 5 selected farms were distributed over the south-west of Western Australia; 30-50 cages were located on each of the farms. Paddock averages were compared to predicted values (Table 1).

Table 1. The r^2 for predicted and paddock PGR, and for combined paddocks, on farms in south-west Western Australia during the 2003 season.

Farm	1	2	3	4	5	Overall
MODIS	0.83	0.46	0.90	0.84	0.50	Paddock PGR = 1.1x -2.9 r^2=0.74
AVHRR	0.66	0.10	0.74	0.80	0.40	Paddock PGR = 1.1x + 2.9 r^2=0.54

The accuracy of prediction for Farms 1, 3 and 4 was markedly higher than 2 or 5 (Table 1). Farm 2 contained a large number of parkland-type scattered trees. Although the image had forest and remnant vegetation removed, this type of vegetation remained, reducing the accuracy of PGR prediction. Farm 5 was badly affected by prolonged low soil temperatures due to frosts. Field PGR was between 1-10 kg/ha/day on this farm compared with 20-30 kg/ha/day on adjacent non-frost affected farms. Modifications to the model will be made to account for these events in readiness for next season.

This validation has shown PGR can be estimated at farm and paddock scale at weekly intervals. Since the inception of MODIS in 2002 and 2003, accuracy of PGR prediction has increased. Point source models applicable to land management decisions have been developed to a high level of complexity, however, are constrained by the lack of spatial distribution and frequency of input data that can only be provided by spatial GIS modelling techniques such as that described here.

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