PASTURES FROM SPACE – VALIDATING REMOTELY SENSED ESTIMATES OF FEED-ON-OFFER

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The Pastures from Space consortium (Mata *et al*. 2004) has developed a range of remote sensing-based spatial information tools for sustainable and profitable management of Australian grazing industies. One such tool is feed-on-offer (FOO^{TM}) which quantifies (kg/ha) the amount of pasture biomass available for grazing at a given location at a particular time. The FOO^{TM} information is critical for improved productivity of grazing systems, and forms the basis for feed budgeting. Many producers are unable to accurately measure FOO^{TM}, and have little time to manually measure FOO^{TM} in all farm paddocks on a regular basis. The objective of this study was to investigate the ability of remote sensing technology to provide regular FOO^{TM} estimates of acceptable accuracy to farmers spread over a large area of south-west Western Australia.

An empirical spatial model (Edirisinghe *et al*. 2000) determines the FOO^{TM} using satellite derived Normalised Difference Vegetation Index (NDVI) data together with the cloud cover and some season specific information. The NDVI is calculated as (red band – NIR band) / (red band + NIR band)), where 'red band' and 'NIR band' are the reflectance values of red and near infrared (NIR) spectral bands of satellite imagery. Five farms distributed over the south west of WA were chosen to get a reasonable geographic distribution in 2003. Paddocks within the farms were selected to test FOO^{TM} on different soils. In the field, FOO^{TM} were measured on transects which were georeferenced to be able to uniquely register in a GIS system (Edirisinghe et al. 2000). High-resolution imagery from Landsat 5 and 7 satellite sensors were sourced to match field observed FOO^{TM} on a monthly basis. Field observed and satellite based remotely sensed paddock FOO^{TM} averages were then statistically compared.

Table 1. The r^2 for the relationship between estimated and observed average FOO^{TM} on farms in 2003.

Farm	1	2	3	4	5	Overall
r^2	0.79	0.40	0.76	0.76	0.85	0.73

The satellite-based FOO^{TM} estimates accounted for 73% of variation in FOO observed in the field (Table 1). The low r^2 of Farm 2 was a result of a 13-day time lag between the dates of satellite overpass and the corresponding field FOO^{TM} measurement for the August image, creating a substantial error in validation statistics. The time lag should be less than 5 days to achieve acceptable validation accuracy (Edirisinghe *et al*. 2002). When the troubled image was removed from the analysis, r^2 from Farm 2 was improved to 0.90. The cloud cover limited the number of images available for this Farm to 3, thereby also contributing to the low r^2, while all other farms in the study group had at least 6 images collected over the season. The remedy for cloud cover problems for any farm is to source imagery from other sensors such as SPOT 1, 3 and 4, and IKONOS, in additional to the LANDSAT imagery. This will also provide an opportunity to pick matching imagery with minimum time lags from a range of possible images. The overall r^2 in 2003 was comparable with previously published (r^2 = 0.74) results (Edirisinghe *et al*. 2002), indicating the temporal consistency in FOO estimates. This validation study showed that paddock scale FOO^{TM} can be estimated with reasonable accuracy over a large area of Western Australia using satellite imagery on a monthly basis.

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