



# SPATIAL INFORMATION DAY 2010

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## Spatial Information Day 2010 Abstract

**Title:** Rangeland monitoring using remotely-sensed cross-fence comparisons

**Session:** 3 – Environmental Management

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### Abstract:

#### Introduction

Rangelands are extensive, often remote regions of our planet, and difficult to monitor using field methods alone; consequently remote sensing is often suggested as a means of monitoring rangeland production and degradation. However, it can be difficult to decipher degradation and the effects of rangeland management from the wealth of information present in remotely sensed imagery, against a background of natural landscape and climate variation. Paired sampling designs involving cross-fence comparisons allow control of natural independent variables, and have been used widely in ecological and rangeland studies. We present an innovative methodology for controlling the background environmental variation present in rangeland systems, allowing the use of remotely sensed imagery to rank paddocks against each other based on cross-fence comparisons.

#### Methods

Remotely-sensed vegetation cover is used as a surrogate for land condition. The image-derived cover data is sampled in pairs at regular intervals, either side of paddock (field) fencelines. The ratio of condition for two adjacent paddocks can thus be determined using the mean cross-fence ratio ( $r_{pi}$ ). The relative score for each paddock can then be determined as the mean of all its neighbours' values, multiplied by their cross-fence ratios:

$$v_p = \frac{1}{m_p} \sum_{i=1}^t r_{pi} v_i$$

Where  $v_p$  = value of a paddock,  $m_p$  = number of neighbouring paddocks,  $r_{pi}$  = mean cross-fence ratio,  $v_i$  = value of all other paddocks in system,  $t$  = total number of paddocks in the system. The set of simultaneous linear equations subsequently developed, one for each paddock, is solved to provide a relative value to be used as a rank for each paddock in the system.

We have conducted trials of this method using small and large scale model paddock arrangements and simulated cover rasters. We also tested it in an arid rangeland and mining area of South Australia using Landsat TM imagery, comprising of 20,392km<sup>2</sup>, 12 properties, and 121 fenced paddocks.

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## Results and Discussion

Theoretical modelling shows that the fundamental premise of the methodology holds, and points to some of the potential improvements needed, such as accounting for the effects of distance to water (grazing gradients). Application in the test region produced a ranking of paddocks consistent with local expert assessments of condition, in the absence of any suitable comprehensive field monitoring data. This method is restricted to developed rangeland areas where grazing is conducted in discrete management units divided by fences. It controls for independent environmental variables without the need to quantify them. Our ongoing development of the methodology will include weighting factors to account for the effects of grazing gradients on vegetation cover at the fenceline sample points, thus accounting for variations in condition throughout the paddock. Application of this approach to different epochs of satellite imagery will allow temporal monitoring of relative rangeland condition over broad areas.

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