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PUTTING PATCHKEY INTO PRACTICE – INVESTIGATING LANDSCAPE SCALE PATCHINESS

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ABSTRACT

PATCHKEY is a new conceptual patch classification model extending the QLD DPI&F ABCD system for describing grazing induced patch changes. Using both vegetation and soil variables we are able to describe "key" patch types which have an associated hydrologic function, and describe overall landscape health. Here we investigate the practical application of PATCHKEY using quick pass transect based sampling, linked to remote sensing to describe landscape condition and derived hydrological function over large areas. A classified image was derived using the ground data to ground truth high resolution imagery. The classified image was studied for patch type size and arrangement for three landscape positions of high, medium and low cover. The match between hydrologic function to PATCHKEY derived patches was also investigated.

INTRODUCTION

Grazing pressure on rangelands has led to changes in the size, composition, spatial arrangement and hydrologic function of patches on a landscape scale (Fuls 1992, Tongway and Ludwig 1997, Bisigato et al 2005, McIntyre and Tongway 2005, Northrup et al 2005). It has, and may always be difficult, costly and time consuming, to describe landscape function, land condition and leakiness (hydrologic functions) at large scales using ground based methods. PATCHKEY (Corfield et al 2006) addresses this problem by allowing us to explore the relationships between land condition, landscape leakiness and the size and distributions of patches (using vegetation and soil properties) in landscapes of differing land condition and grazing history. PATCHKEY is an extremely useful, quick pass, tool for delivering a quantitative spatial dimension to landscape metrics, and has the potential to be used, in conjunction with high resolution satellite imagery to monitor landscape health, especially landscape leakiness. This study was conducted in order to test this potential in a largely *Bothriochloa pertusa* (an exotic perennial grass having a stoloniferous habit) dominated rangeland south west of Townsville, Qld, Australia.

METHODS

Quick pass transect sampling was conducted on three areas of high-site 3, low-site 2 and medium-site 1 cover (fig1): as decided from a December 2005 high resolution Quickbird image covering Virginia Park, a property south west of Townsville. Transect sampling was conducted over 5 transects for each area, transects being 300m long and 40m apart, effectively covering a total area of 6 ha. Transects were orientated downhill in all cases, to assist in differentiation of patch types in upper and lower slopes. A differential GPS was used to record the starting point for each patch type along a transect, and the PATCHKEY attributes were recorded for each patch as it was captured. Patch type line segments were then created between consecutive patch type start points using GIS software, in effect giving us a linear representation of patch types along each transect. The 0.6m pan sharpened multispectral

Quickbird imagery was cropped to the Top Aires paddock boundary and classified using isoclass cluster analysis to give 30 clusters overall (more than the total amount of patches found on the transects). Line segment data was overlayed onto the cluster image in the GIS and the clusters were grouped according to PATCHKEY types found in the line segments for each site creating a PATCHKEY classification image (Figure 1). The classified patch image was assigned an image classification reference from B1….D4, for comparison purposes, QDPI&F ABCD landscape condition (Chilcott et al 2003) and infiltration rate, derived from measures developed in previous work as part of the MLA *Sustainable Grazing for a Healthy Burdekin Catchment* project. Patch metric data was extracted from final image classification and compared with transect data on the areas bounding site 1 to 3 (square site boundaries Figure 1).

RESULTS

Transfer from PATCHKEY to remote sensed data was successful with a fully classified image being created. Land condition as modified by PATCHKEY, and infiltration values were able to be attached to the classification (Figure 1) using the PATCHKEY associated values. Proportions of patch types were found to match well between on ground sampling efforts and remote sensed classification (best seen in figure 2 where patches are grouped into ABCD condition states). Figure 2 shows all patch groups for ground sampling and remote sensing, showing the same patterns with some spread of patches between the on ground and classified image (see Figure 1 key).

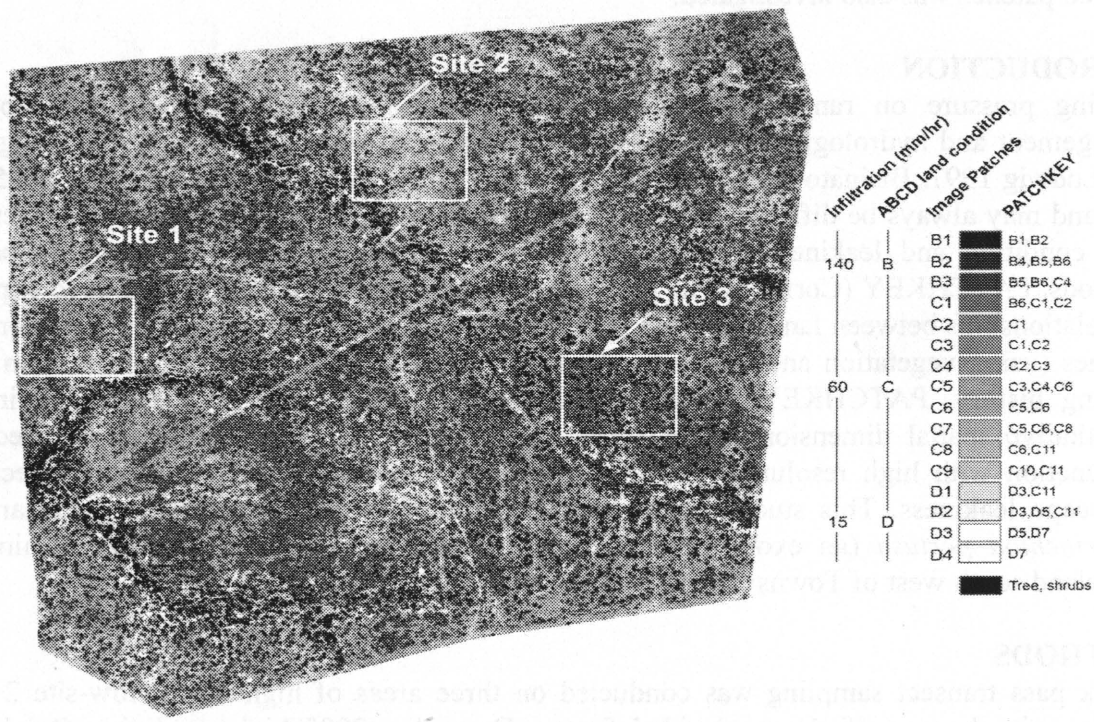

Figure 1: Classified Quickbird image showing site locations, PATCHKEY patches, Image classification patches, associated ABCD land condition and Infiltration (mm/hr)

Site 1 rests mainly in the medium C patch areas for both on ground and classified image (Figure 2 a,d) with some low B patch areas being found on upper slopes and around trees (Figure 1). Site 2 predominantly sits in the very low C to D patch class (C11 in the transect samples being closely related to the D classes in the classified image) (Figure 2 b,e). The ground based sampling is more sensitive to D class for site 2 (Figure 2 b,e). Site 3 shows patch class proportions towards the higher end of the C class and lower B classes (Figure

2c,f). There was no significant difference between mean patch sizes for site 1 with sizes of 20, 18 and 19 m^2 for B, C and D patches respectively. Site 2 had significantly different patch sizes of 13, 18 and 25 m^2 for B, C and D patches and site 3 of 15, 19 and 11 m^2 for B, C and D patches. Contagion measures of patches for all sites were similar having between 35% and 38% relative contagion suggesting clumping of some groups is occurring at that level.

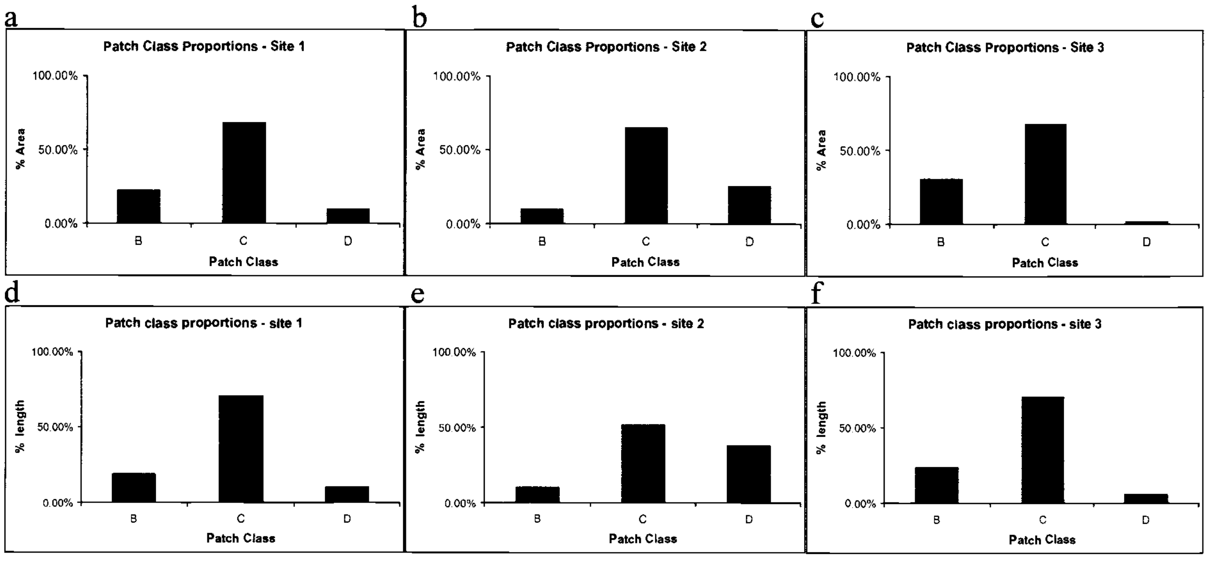

Figure 2: Patch as a proportion of site for the classified image a-c (% area) and transect samples d-f (% of length). Patches grouped into ABCD condition

DISCUSSION

The match of transect based ground sampling and the remote sensed data indicates that the PATCHKEY transect based method is suitable for detecting landscape function/condition without the use of extra remote sensed data, to at least a paddock scale. Transect based sampling is more sensitive to degraded patches than the remote sensed data, although this may be rectified using a weighted mean patch size index (Li and Archer 1997), increasing patch detection sensitivity for the remote sensed classification. This makes both the transect method and remote sensed application very useful for detection of degraded vegetation and hydrologic function, particularly when coupled with Landscape Functional Analysis (Tongway and Hindley 1995). The apparent similarity in PATCHKEY patch profiles between the medium cover site 1 and high cover site 3 areas indicates that these two areas are very similar functionally. PATCHKEY may, therefore, be a very useful tool in informing other remote sensed models which give an indicator of landscape function such as the Directional Leakiness Index developed by Ludwig et al (2002). Further measurements into patch clumping could be used to look at specific patch type distributions within a landscape; instead of a single relative contagion value. This may give us more insight into patch formation.

We conclude that PATCHKEY is a very useful tool giving us a useable ground based method for obtaining landscape function over large areas, through the use of remote sensed information.

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