PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY BIENNIAL CONFERENCE
Official publication of The Australian Rangeland Society

GRAZING PREFERENCE, PATCHINESS AND LAND CONDITION INTERACTIONS: IMPLICATIONS FOR RECOVERY IN UPPER BURDEKIN GRAZING LANDS

J.P. Corfield and B. N. Abbott

CSIRO Sustainable Ecosystems, Davies Laboratory, Townsville Q 4810

Email Jeff.Corfield@csiro.au

INTRODUCTION

Factors that influence selective grazing preference occur at a range of scales and include both edaphic elements such as topography, vegetation community, soil type and human influences such as paddock configuration, water and supplement placement and burning strategies. Cattle also graze patchily and many of the processes and interactions that impact upon land condition and hydrological function begin at the grazed patch scale. Previous studies (Andrew, 1986) found that once such grazed patches are initiated, cattle tend to re-graze them selectively within continuously grazed systems, which can result in localised degradation of land condition. If unchecked, such degradation can lead to increased landscape leakiness (Ludwig *et al,* 2002) and reduction in hydrological function at the paddock scale and beyond.

A recent MLA supported project *Sustainable grazing for a healthy Burdekin catchment* (Post *et. al*., 2007) examined the various factors influencing grazing distribution and selection preference in six commercial paddocks across a range of land types, land condition and stocking histories in the upper Burdekin region of north Queensland. This project also examined grazing distribution and selective preference in response to application of Ecograze (Ash *et al*, 2001) derived sustainable grazing strategies (including lower utilisation and wet season spelling) in 4 commercial paddocks at Virginia Park station, Mingela, North Queensland, between 2002 and 2006. This paper reports the findings of those studies with respect to the influence of patch scale selectivity, its interaction with other key factors influencing grazing preference and the implications for managing recovery in the texture contrast land types of the upper Burdekin.

METHODS

Transect based surveys were completed on six commercial paddocks representing a range of land types, paddock sizes, grazing histories and land condition states typical of the upper Burdekin region. These surveys, conducted in both wet and dry seasons between 2003 and 2005, recorded patch scale grazing activity using the relative defoliation rating method of Andrew (1986) at predetermined, GPS located, sampling points along each transect. Data on pasture biomass and composition, perennial grass basal area class, ground cover, litter cover and soil surface condition were recorded from a 2m*2m virtual quadrat at sampling point, along with details of surrounding topography, tree and shrub population and canopy cover, soil type and vegetation unit. In the Virginia Park study fixed point grids were used for both hillslope and paddock scale end of wet and end of dry season surveys. A similar quadrat size and range of herbage and ground layer variables were recorded, along with associated land type and vegetation unit information.

In both studies, ABCD land condition classes (Chilcott *et al.* 2003) for the dominant patch type present at each sampling point were determined using the PATCHKEY method of Corfield *et al.* (2006). PATCHKEY draws together both structural and functional elements of land condition, and so is a good indicator of medium to long term condition due to pre-existing longer term grazing impacts rather than contemporary defoliation, enabling use of defoliation as an index of selective preference for patch condition. The relative influence and interaction of key factors such as land type, vegetation cover, tree/shrub cover, distance from water and fences and land condition on relative defoliation intensity, was examined using univariate and multi-variate statistical analysis techniques (see Post *et al.* 2006).

RESULTS

Results reported in Post *el al*. (2006) confirmed findings from earlier Burdekin studies (Roth *et al.* 2003) that distance from water had a significant but localised (<300m) impact on paddock scale grazing distribution in moderately stocked study paddocks, while there was a clear selection preference for riparian and frontage land types on some sites, especially in the wet season. However, by far the most consistent driver of small scale grazing distribution and selection preference at moderate stocking was pre-existing land condition at the patch scale. Results from seasonal surveys of commercial paddocks in the upper Burdekin showed that the proportion of quadrats recorded as heavily grazed (defoliation >50%) in pre-existing C (poor) and some D (very poor) condition patches was up to twice that recorded in adjacent B (good) condition patches (Chi sq. 7.96, p<0.005) and up to five times the proportion recorded in adjacent A (very good) condition patches (Chi sq. 13.79, p<0.005), where they existed (fig. 1a).

This selection preference was also explored by scaling relative defoliation recorded for each patch condition class against relative abundance for that patch class, using the relative selectivity/electivity index method of Jacobs (1974). Figure 1b shows the same data sets used for fig. 1a but expressed as a relative selectivity index score. Again, this shows a relative selection preference for C (poor) and D (very poor) condition patches over B (fair) and A (good) condition patches in the same paddocks.

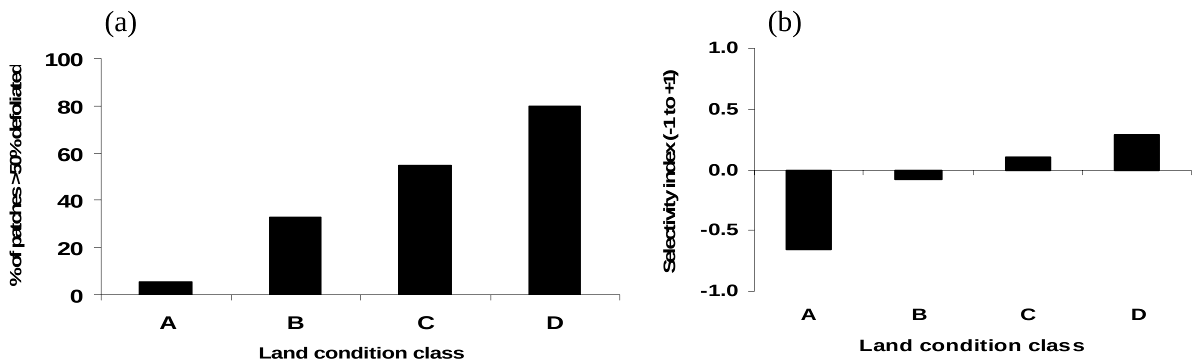

Figure1: Two measures of selective preference of patch condition from the same moderately stocked paddocks on texture contrast land types in the upper Burdekin (a) proportion of each ABCD patch condition class quadrats heavily grazed (>50% defoliated) by end of dry season 2004 and (b) relative selectivity of the same patch class condition class quadrats using the method of Jacobs (1974). A=good, B=fair, C=poor and D=very poor condition patches.

By contrast at Virginia Park the Aires paddocks showed no significant selection preference for C and D condition patches at the commencement of the study, as the paddocks had been subject to uniformly high stocking rates for many years before the implementation of more sustainable grazing practices. If anything, there was a small positive selection preference for the few remaining B condition patches (fig. 2b) due shortage of pasture biomass at that time even though there was a higher proportion of heavily defoliated C condition patches (fig 2a). However as recovery progressed in response to overall lower paddock utilisation following the severe 2003 drought, a positive selection preference for C and D condition patches began to emerge (fig 2b).

As pasture biomass improved through 2005 in response to wet season spelling and reduced utilisation, the proportion of heavily grazed quadrats fell across all patch condition classes. A return of near average rainfall conditions in 2006 coupled with a shift back from low to moderate dry season utilisation regime (overall 40% utilisation) following the conclusion of the project saw the relative proportion of heavily grazed C and D condition patches rise sharply to levels similar to that recorded in the earlier commercial paddock study (fig. 1a) with the proportion of heavily grazed quadrats (defoliation >50%) recorded in pre-existing C (poor) condition quadrats over twice that for adjacent B condition quadrats (Chi sq. 31.16, p=0.0000) and the proportion of D condition heavily grazed quadrats over three times that recorded for B condition (chi sq. 34.02, p=0.0000). Relative selectivity for C (poor) and D (very poor) condition patches also approached those shown for moderately stocked commercial study paddocks in fig. 1b).

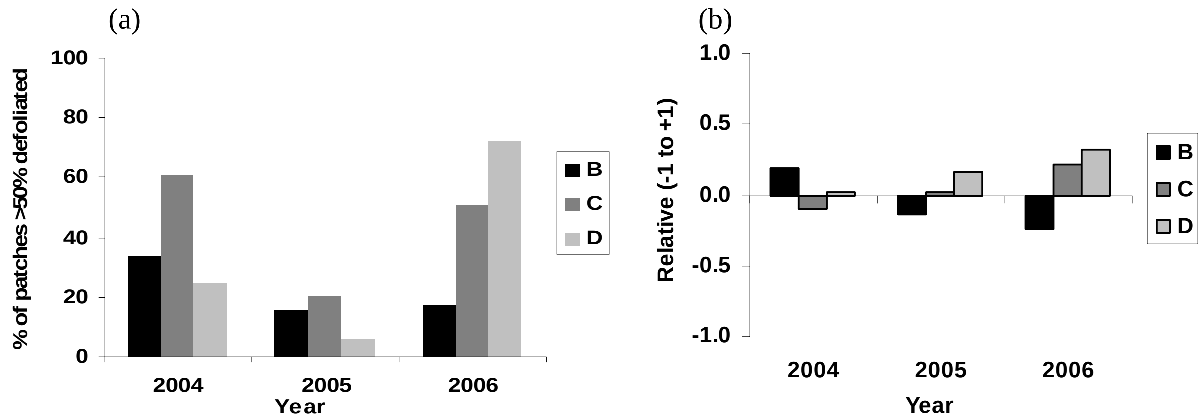

Figure 2: Trends in (a) proportion of heavily grazed (>50% defoliated) quadrats in each patch condition class and (b) relative selectivity scores for the same patch condition classes over the first 3 years of recovery in Aires paddocks, Virginia Park following the drought of 2003 and start of wet season spelling and reduced utilisation.

Where such C and D condition patches coincided with preferred and/or vulnerable land types e.g. riparian zones, lower slope sodic soils, this compounded selective grazing pressure leading to significant local degradation and/or slowing of the rate of recovery in those land types). Lower slope mixed shrub/sodic soil communities at Virginia Park recorded twice the proportion of heavily grazed (<50% defoliated) quadrats than neighbouring ironbark/bloodwood (*Eucalyptus. crebra / Eucalyptus. melanophloia*) communities (Chi sq. 9.86, p=0.0017) especially in the early wet season (fig. 3a). Land condition metrics such as ground cover showed virtually no recovery on these same areas compared with adjacent ironbark/bloodwood upper and mid-slope communities (fig. 3b) during the period 2003 to 2006.

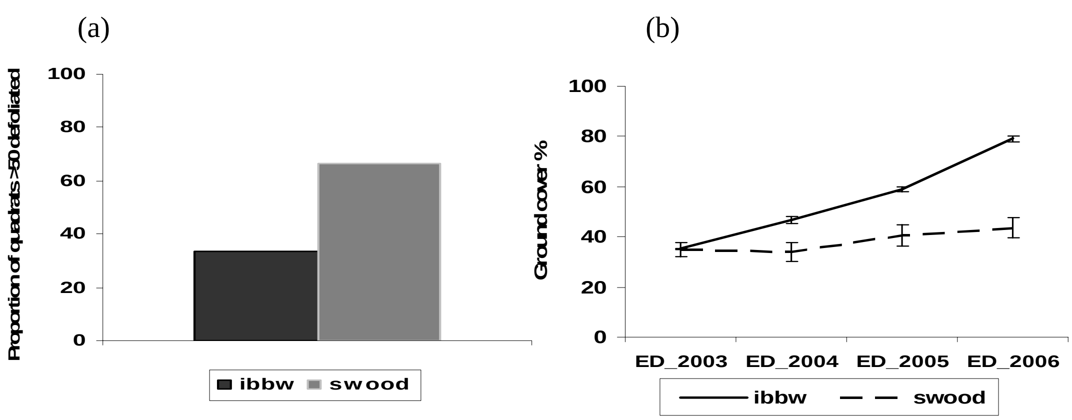

Figure 3: (a) proportion of quadrats heavily grazed (<defoliation >50%) and (b) end of dry season (ED) ground cover trends for two main vegetation types, the dominant ironbark/blood (ibbw) and minority sandalwood/sodic communities (swood) during the recovery years 2003-06 in Aires paddocks, Virginia Park station.

DISCUSSION

This study identified a positive feedback loop whereby stock target existing C and some D condition patches for continued preferential grazing under certain conditions, thus maintaining or further degrading those patches – a finding in accord with that of Andrew (1986b). Even with reduced stocking rates and introduction of wet season spelling, continued targeting of the same C (poor) and D (very poor) condition patches impacted on the overall rate of recovery and the restoration of paddock scale land condition and hydrological function at Virginia Park. While there was an 8% shift back from C (poor) toward B (fair) condition for the Aires paddocks between 2003 and 2005 there was also a 9% shift from C (poor) back to D very poor) condition during this same period, indicating some continued degradation in some land types and locations within the paddocks, despite overall improvement.

This is a particular challenge for managing recovery in C (poor) condition paddocks, especially those texture contrast land types dominated by *Bothriochloa pertusa*. The Virginia Park study indicates that in recovering C condition paddocks, premature return to even moderate stocking rates can significantly increase the selective targeting of C and D condition paddocks, which can impede restoration of connectivity between recovering patches across the landscape and even open up old leakiness pathways.

Regular wet season spelling is one key paddock-scale management practice that can help mitigate the impacts of selective grazing of recovering C and D condition patches by protecting them during the growing season when remnant 3P grasses within these patches are most vulnerable to grazing. Maintaining low stocking rates well into the recovery cycle will also assist by reducing overall utilisation as demonstrated in fig. 2a for 2005. Strategic use of fire (using mosaic burning principles) can also help redistribute grazing away from existing poor condition patches (Andrew, 1986a).

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