

APPLICATION ABSTRACTS

Relationship of aircraft radiometric measurements to bare ground on semi-desert landscapes in central Australia

B.D. Foran and G. Pickup

Satellites such as Landsat have potential for contributing to rangeland management because they provide data for large areas at regular intervals which can be easily and rapidly processed by computer. Their potential will not be fully realised until it is possible to relate satellite to ground characteristics such as percentage vegetation cover.

This paper examines how accurately the amount of vegetation cover may be estimated from data similar to that obtained from Landsat. It shows that reasonable accuracy may be obtained but that different prediction equations may have to be derived for different landscapes.

Points of reference in the assessment of change in vegetation and land condition

A.D. Wilson

An analysis is made of the use of reference areas as standards for assessing the condition of rangeland.

It is concluded that reference areas have a valuable role in separating vegetation changes attributable to management from those attributable to climatic variation. However, the use of small ungrazed exclosures is not recommended as these overestimate the degree of change. This is because small areas are usually favoured parts of the landscape, natural variation in land is unfairly included as 'change' and ungrazed land is not an appropriate standard for grazed land.

The use of multiple reference areas is proposed. This reduces the temptations to choose 'the best' area as a standard and allows correction for natural variation in vegetation across land units. They should be chosen for their high potential productivity, rather than as ungrazed or 'original' vegetation.

Soil water storage in a semi-arid *Eucalyptus populnea* woodland invaded by woody shrubs, and the effects of shrub clearing and tree ringbarking

G.G. Johns

Soil water was monitored over a six year period in semi-arid shrub invaded poplar box woodland in north-western New South Wales. Measurements were made under both the shrubby thicket areas near the eucalypts, and the sparsely shrubbed interthicket areas more distant from the trees. A bulldozer had been used to clear shrubs from part of the area, and on some of this cleared area the eucalypts were also ringbarked.

Stored soil water fluctuated more widely under the thickets compared to the interthicket areas. More soil water was stored under thickets after heavy rain. With the return of dry weather this extra soil water was rapidly depleted, and thicket soils would often become drier than interthicket soils.

Where all shrubs had been cleared an extra 20% soil water was stored, while an extra 70% was stored on the shrub cleared areas where the eucalypts were also ringbarked. The effect of ringbarking was still pronounced at a distance of 25 metres from the tree.

It was concluded that the removal of both shrubs and trees was necessary to make a big difference to stored soil water in such a dry environment.

**Seasonal variation in *in vitro* digestibility and chemical composition
of a range of alpine plants, from Victoria, Australia**

H. van Rees and J.A. Beard

The effect of seasonal changes in nutritional value of a range of alpine plants was investigated. The results show that towards the end of the short alpine grazing season several of the alpine plant species analysed were unable to provide cattle with sufficient energy and protein. Macro-element content of the plants was insufficient for optimum animal production.

The dynamics of a Mitchell grass (*Astrebla* spp.) rangeland on the Barkly Tableland, Northern Territory

B.D. Foran and G. Bastin

The Mitchell grasslands of the Barkly Tableland, N.T., are an important rangeland resource for cattle production in northern Australia. This study was designed to test the effects of protection from grazing and distance from water on such a pasture over six years. It found that the series of above average summer rainfalls encountered produced much bigger differences than either imposed treatment. A reduction in the yield of palatable annual Flinders grass (*Iseilema vaginiflorum*) and an increase in unpalatable Feathertop (*Aristida latifolia*) lowered the grazing value of the pasture. This deterioration was partly offset by an increase in Mitchell grass (*Astrebla pectinata*) towards the end of the study. The increase in Mitchell grass should extend the value of the pasture for animal maintenance in the late dry season.

Relationships were developed between species plant cover and yield which would assist the rapid estimation of range condition based on forage yield and quality concepts.

**Observer differences in transect counts, cover estimates and plant size measurements
on range monitoring sites in an arid shrubland**

A.McR. Holm, P.J. Curry and J.F. Wallace

A field trial was held to estimate between-observer differences in recording perennial shrub data on fixed transects over a range of arid shrublands near Carnarvon, Western Australia. Transects used in the trial were designed to simulate those at range monitoring sites to be established within comparable grazed shrublands throughout Western Australia.

Observers counted (by species) and measured major axes dimensions of various tall and low shrubs, with coefficients of variation below 10% with few exceptions. Measurements of foliar cover by line and point transects were far less reliable.

Property build-up in south-west Queensland – Prospects and impediments

W.E. Holmes

In a study of property build-up in the Charleville district of Queensland, the extent of recent past property build-up, and of intended future build-up, was documented. Reasons for graziers' failures to expand were explored. It was found that physical constraints on property expansion were about as important as financial constraints. Most intending expanders considered only one or two blocks of land to be suitable as additional areas. Suitability usually required that the additional area adjoin the home block. Expanding graziers often had to wait years for these blocks to be offered for sale, and then compete with other buyers. Suggestions are made as to how this and associated impediments to property build-up may be overcome.

The Brucellosis-Tb eradication campaign: Some implications for the pastoral areas of the final phase

Joe Johnston

Federal and State governments are formalising agreements for some \$300 m of public and industry-sourced funds to be directed to finalising eradication of these two cattle diseases by 1992. The campaign has been in operation nationally since 1970, and the official campaign expenditure so far (in present day dollars) totals \$375 m. This does not include producers' on-property expenses. Progress has been made towards eradication in the closer settled parts of Australia. The final phase of the campaign, as well as being concerned with securing the disease free status gained in the south, will be concerned with overcoming some serious and as yet unresearched problems in northern and central Australia.

In complying with campaign requirements in the rangeland areas, producers face substantial extra operational costs. On some properties improvements need to be financed specifically for disease control, overcapitalising the beef enterprise. For lack of any satisfactory way of identifying Tb infected cattle in some of the wilder areas, complete destocking of some grazing lands will be necessary, perhaps never to be repopulated.

The campaign is necessary if the industry is to keep up with perceived consumers' quality requirements and remain internationally competitive. Property management advisory services are being improved to assist producers and administrators to select disease control strategies which make reasonable use of public funds while disrupting producers as little as possible. Various forms of financial help are available to offset some of the extra costs of mustering, testing, or eliminating unwanted cattle. But for some producers, such assistance will not be enough. Campaign-induced problems could be passed on to rural reconstruction and land administration bodies.

Some areas are identified where research might assist in making for a beef cattle industry which is more in harmony with the pastoral resource base.

RELATIONSHIP OF AIRCRAFT RADIOMETRIC MEASUREMENTS TO BARE GROUND ON SEMI-DESERT LANDSCAPES IN CENTRAL AUSTRALIA

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Abstract

Radiance values in Landsat MSS bands were measured over five landscapes typical of central Australia: a calcareous plain, an eroded calcareous plain, a gibber plain, a floodplain and a savannah woodland, using an aeroplane-mounted Exotech four band radiometer flown at a height which gave Landsat pixel-sized sampling areas. Forty-five radiometric variables derived from these radiance data were correlated with the amount of bare soil interpreted from aerial photos. On the calcareous plains and the floodplain, the highest correlations were obtained with the visible bands, Band 4 and Band 5, and the difference between them. On the gibber plains and savannah woodlands the best correlations were obtained with the ratio of Band 5 to Band 7 and the subtraction ratio of B4-B5/B4-B7. A series of linear relationships were developed linking bare ground with radiometric variables which explained between 70% and 85% of the variation. Multiple regression analysis on the radiometer indices most highly correlated with total bare ground showed that inclusion of other cover variables such as litter, shadow, soil colour and herbage cover increased the variation explained by only 5-10%. A test of the effect of differences in solar elevation angle on the 45 radiometric variables showed that the radiance values in each band and differences between them were significantly affected. Eight indices were affected to a lesser degree and may be useful for multi-temporal work. Some considerations of the use of the selected indices for practical landscape monitoring are also discussed.

Introduction

Pastoral properties in inland Australia are large and subject to an erratic and unpredictable climate. Government agencies which are responsible for pasture lands must monitor Australia's rangelands at a level commensurate with the large areas involved, low productivity per unit area and within the limits of available personnel. Landsat technology with its repetitive coverage of large areas is an appropriate tool to apply in the initial stages of landscape monitoring.

Landsat MSS radiance data on rangelands are a function mainly of the soil reflectance and the degree to which the soil surface is masked by vegetation cover, particularly if that vegetation is green. The vegetation cover is a function of the preceding rainfall and grazing levels and is frequently sparse. If Landsat data are used to aid monitoring of rangelands, they must be able to separate the effects of vegetation from those of soil characteristics. This may be difficult when only a limited amount of vegetation is present.

Vegetation cover on semi-arid landscapes comprises three structural units: trees and shrubs, standing herbaceous, and litter cover. Of these, the herbage layer is the most important for rangeland use, but detection of change within it is confounded by the influence of the other units. Furthermore, it has been suggested that threshold levels of plant cover exist below which plant plus soil reflectance cannot be distinguished from soil reflectance (Satterwhite *et al.* 1982). Plant cover may often be below threshold levels

and so we need to determine these levels. Because plant covers are small and transitory in nature, we have chosen the amount of 'bare ground' as the most appropriate landscape characteristic for monitoring in these regions.

Rationale

There are three main problems in developing a relationship between radiance and vegetation cover in rangelands. These arise from the diversity of soil and vegetation colours, changes in illumination during the year, and the amount of green vegetation present.

Central Australia contains a wide range of soil and vegetation types and colours. This makes it difficult to predict vegetation cover from radiance because of interaction with soil colour. Uniform soil-vegetation systems allow more accurate measurement of vegetation characteristics (McDaniel and Haas 1982) than heterogeneous systems (Deering *et al.* 1977; Westin and Lemme 1978). Thus in exploring relationships between bare ground and radiance, a selective approach was taken. Five common landscape types were chosen (Table 1), which are broadly representative of the best and most intensively used grazing country in central Australia.

Differences in the angle of solar elevation and, hence the degree of scene illumination, are important variables in multi-temporal work with Landsat. Our radiometer data were obtained for solar elevation angles between 38° and 58° for the landscapes sampled