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

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Paper for the Australian Rangeland Society, Broken Hill, July, 1977

Range condition surveys with an interval of 2 years.

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It has been said in the last few years that the management of rangelands must proceed through three stages:-

(1) An inventory of the natural resources;

(2) Determination of the successional stage of the vegetation resource (the range condition);

(3) An assessment of the change in the condition of the natural resources attributable to management (the range trend).

If one accepts the view that the only major manipulation open to rangeland managers wishing to improve their land lies in the adjustment of stock numbers, then in theory, stocking intensity must be altered flexibly according to the way range trend is going. Range assessment has reached the third of the above stages in central Australia, and this paper considers the derivation of range trend from the difference in results of two condition assessments with a time lapse of two years.

In Oct.-Nov., 1974 the Department of N.T. Animal Industry and Agriculture Branch and CSIRO jointly carried out a survey of four cattle stations (7700 sq. km.) of the Burt Plain, north of the Macdonnell Ranges, C.A. In late 1976, these organisations re-surveyed the same area. The aim of the first survey (Burt Plain Survey) was to describe and map the area into ecological land units based on cattle usage. At the same time, the STARC methodology of assessing range condition was tested. The second survey conducted by the A.I. & A. Branch, the Grazing Capacity Assessment, used the STARC condition method as a basis for setting safe stocking levels on some important rangeland types of the district. Data was collected from approximately 60 sites on both surveys.

The Study Area

There are five major rangeland types on the 7700 sq. km. of central Australia under consideration. The depositional surfaces of Hamilton land system adjacent to the northern foothills of the ranges, (Perry, 1962) contain a floodout unit, treeless with annual grasses and forbs growing on eroded, texture-contrast soils ("Cottonbush Floodout" unit). Within the same land system, open woodland occurs on coarse-textured alluvial soils, having scattered palatable shrubs and trees over nutritious short grasses and forbs (e.g. Enneapogon spp., Aristida contorta). This "Open woodland" grades into mulga with an predominantly annual understorey on more loamy soils. This "Mulga-annual" unit grades in turn into more typical mulga rangeland with perennial shrubs (e.g. Eremophila spp.) and grasses (e.g. Eragrostis eriopoda, Monachather paradoxa) extending out into the fringes of the spinifex sandplain. Interspersed along the foothills are areas of Mitchell grassland (Astrebla pectinata) characterised by gently sloping, treeless plains of heavy clay soils.

For the years 1974-1976 during which the two condition assessments were carried out, rainfall far exceeded the long-term district average of 275 mm. per annum, with 859 mm. for 1974 and in excess of 400 mm. for both 1975 and 1976. Observations in the field on both occasions confirmed that the vegetation conditions reflected near-optimum growth conditions for central Australian plant communities.

The comparability of the surveys.

Range condition scores were obtained on both surveys using the same assessment method (STARC). Additional data were collected in 1974 on soils and woody plants during the development of a reliable range condition methodology. From this came the STARC concentration on the botanical composition index (Lendon and Lamacraft, 1976), and this has become the common ground for comparison between the two surveys.

The details of the second survey procedure in 1976 are spelt out in another paper to this meeting by G. Bastin and G. Pearce. In summary, sampling sites were chosen at fixed (3 km.) distances from cattle watering points. By contrast, the first survey selected sites without regard to the proximity of water, the aim being to obtain ground truth for mapping photo patterns. The result is that, when matching the location of sites for comparison, we can consider two approaches:

(1) The total number of sites assessed in each survey can be averaged (a) for all sites and (b) for each of the five rangeland types ("open woodland", "mulga-annual" etc.)
(2) Pairs of sites, one from each survey, can be identified in the same piece of rangeland, not further than 2 km. from each other.

Results of total sites combined and sites per rangeland type (1) are shown in Table 1. Condition scores between the two surveys do not differ significantly based on Students "t" Test (assuming normal distribution of data) and the Wilcoxon Matched-Pairs Signed-Ranks Test (no assumption of normality). An examination of the coefficients of variation of scores from both surveys shows reasonable agreement, suggesting that this consistent pattern of variation comes from two samples of the same population of plant communities. Thus, when the assessors were faced with the data from two surveys and asked "How representative of the rangeland types are the two sets?", Table 1 shows that the two surveys can be compared.

Condition scores and distance from water

Another source of potential variation between the two surveys might have been the location of sites sampled in relation to the distance from the nearest watering point. The 1974 survey positioned sites for mapping purposes, in a range of 0.5 km. to 9.2 km. from waters, whereas the 1976 survey selected sites that were in a certain land system, mostly around 3 km. (range 2 km.- 6.5 km.) from a watering point, and easily accessible from station roads. When the hypothesis that distance from water has an influence on range condition, as assessed in these two surveys, was applied to the data, a significant relationship was found only for the Open Woodland in the 1976 survey (Table 2). The data shown includes all sites; the same analyses were carried out excluding sites that were closer to water than 1.5 km. and further from water than 6 km. Results remained not significant. In practice, these results would suggest that, for relatively well-watered and well-fenced areas, re-assessment sites located independently of watering points (excluding the immediate sacrifice area) would adequately describe the condition of the general area of the particular rangeland type. More systematic research is being undertaken to determine a station-wide strategy for range condition description.

Repeat sites from same locality

Of the 117 sites assessed for both surveys, 23 pairs were located in close proximity and could be considered as "repeat sites". The condition scores for each pair were compared using both the Wilcoxon and "t" tests with the result that no significant difference could be detected either between all 23 pairs or between groups of pairs from particular rangeland types. An examination of the scores of each pair shows that 52% fall within 0-10 STARC points of each other and 82% within 0-20 points.

Condition class and rangeland type

Figure 1 shows the condition scores distributed into condition classes of 20% intervals. More generalised figures are given in Table 1, in the forms of (i) an overall mean score and (ii) the percentage of sites scoring above 60%, for each rangeland type. These class intervals are commonly used to classify the degree of improvement or degeneration of country, and the above 60% condition rating has been taken as the management goal for the most productive and stable state for livestock production.

Considering first the two mulga rangelands, the mulga-perennial unit is predominantly in good condition in both surveys. The mulga-annual unit is in good condition in 1976 and "high-fair" condition in 1974. Open-woodland rates in fair condition and cottonbush floodout in predominantly poor, for both surveys. It is interesting to note that the condition of these four rangelands coincides inversely with the way Low (1972) observed present-day cattle grazing preferences within one 153 sq. km. paddock of the area.

Mitchell grass plain is also an attractive grazing unit for cattle, and the results suggesting that this is the only rangeland type in worse condition in 1976 than in 1974 (while not a significant difference at the 5% level) may warrant further explanation. It was noted that many Mitchell grass sites in the second survey were limited in area and surrounded by other less-preferred rangelands: these sites were thought to be target grazing areas under heavier and more constant use than the sites sampled in 1974 on more typical, extensive Mitchell grass plains.

Range Trend

We began with the proposition that range trend, the change in the resource base brought about by management factors, may be deducable from the difference between two assessments of range condition with a time interval. The data presented from two condition surveys with an interval of two years does not show a significant difference (at the 5% level) that can be claimed to be a real change, i.e. range trend. But that is not to say that no trend has occurred, and the following points should be made.

(1) The method of obtaining the two sets of condition scores may not have been sensitive or precise enough to detect a small, but real, trend change of say, 5-10%, given the short time interval between assessments.

(2) Two years is a much shorter time interval in which to expect a detectable trend in rangelands than the more usual 5-10 year interval used in range management elsewhere in the world. But all three years, 1974-1976, were exceptionally wet; many plants that were normally annuals perennated and reproduced right throughout this period, and plant communities became appreciably denser. It is to be expected that at such a time - a favourable "pulse" in arid lands - the plants would respond in an opportunistic way. However, it should be stressed that we were not sampling simply seasonal effects : the STARC assessment takes account of erratic, seasonal fluctuations by setting standards from the composition of undisturbed reference areas at the beginning of each assessment survey.

(3) Under this assessment method, range trend would be inferred from a real change in the composition of the pasture, and we need to consider what effect management factors would be having on composition shifts. We know that cattle numbers rose to 1½ - 2 times the stocking levels that applied during the previous few, "dry-normal" years (records from 3 of the 4 stations). Grazing management was not altered appreciably during the study period, but the effect of the expanding cattle population would have been masked to a great extent by their widespread use of the area owing to the abundance of preferred surface water for drinking (Hodder, pers. comm.).

In summary, if the general shift towards higher condition classes as shown in Fig. 1 is real, then improvement has occurred during two wet years in spite of, not because of, management of these lands. We would add a further qualification to the non-significant differences reported in Table 1. By averaging STARC scores across condition classes, we may well have masked regenerative processes occurring at different rates throughout the range condition spectrum. When we related the subjective trend (up, down or static) that assessors were asked to give at each site against condition scores grouped as (i) above 60%, (ii) 40-59%, and (iii) below 40%, we found a pattern. For both surveys, the majority of sites in above 60% condition were assessed to be in upward trend. At the other end of the scale, more sites below 40% were assessed in downward trend than in static or up. It was in the middle range, 40-59% sites, that most sites were assessed as either stable (1974 survey) or downward (1976 survey). The practical consequence of this may be that most effort in sampling range trend should be expended on sites in the median or "fair" condition class.

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TABLE 1

Mean STARC scores, standard deviations, coefficients of variation, number of samples, and tests of significence for the different rangelands in the 1974 Burt Plain and 1976 Grazing Capacity Assessment Surveys.

Rangeland		1974 Survey	1976 Survey	Test 1	Test 2	Sites >60% 1974	Sites >60% 1976
Open Woodland	$\bar{x}$	45.3	53.4	N.S.	N.S.	16%	50%
	s	±13.5	±18.7				
	CV	30%	35%				
	n	25	16				
Mitchell Grass	$\bar{x}$	62.9	54.1	N.S.	N.S.	66%	36%
	s	±17.3	±22.9				
	CV	27%	42%				
	n	15	11				
Mulga-annual Understorey	$\bar{x}$	52.9	66.1	N.S.	N.S.	43%	66%
	s	±19.1	±14.5				
	CV	36%	22%				
	n	7	15				
Mulga-perennial Understorey	$\bar{x}$	63.0	67.9	N.S.	N.S.	58%	86%
	s	±17.6	±11.1				
	CV	28%	16%				
	n	12	7				
Cottonbush Floodout	$\bar{x}$	24.0	35	N.S.	N.S.	0%	0%
	s	±6.4	8.6				
	CV	27%	25%				
	n	6	3				
TOTAL - all rangelands, all sites	$\bar{x}$	51.5	58.1	-	N.S.	36%	53%
	s	±19.1	±18.9				
	CV	37%	33%				
	n	65	52				

Test 1 = Wilcoxon Matched - Pairs Signed-Ranks Test
Test 2 = Students "t" Test.

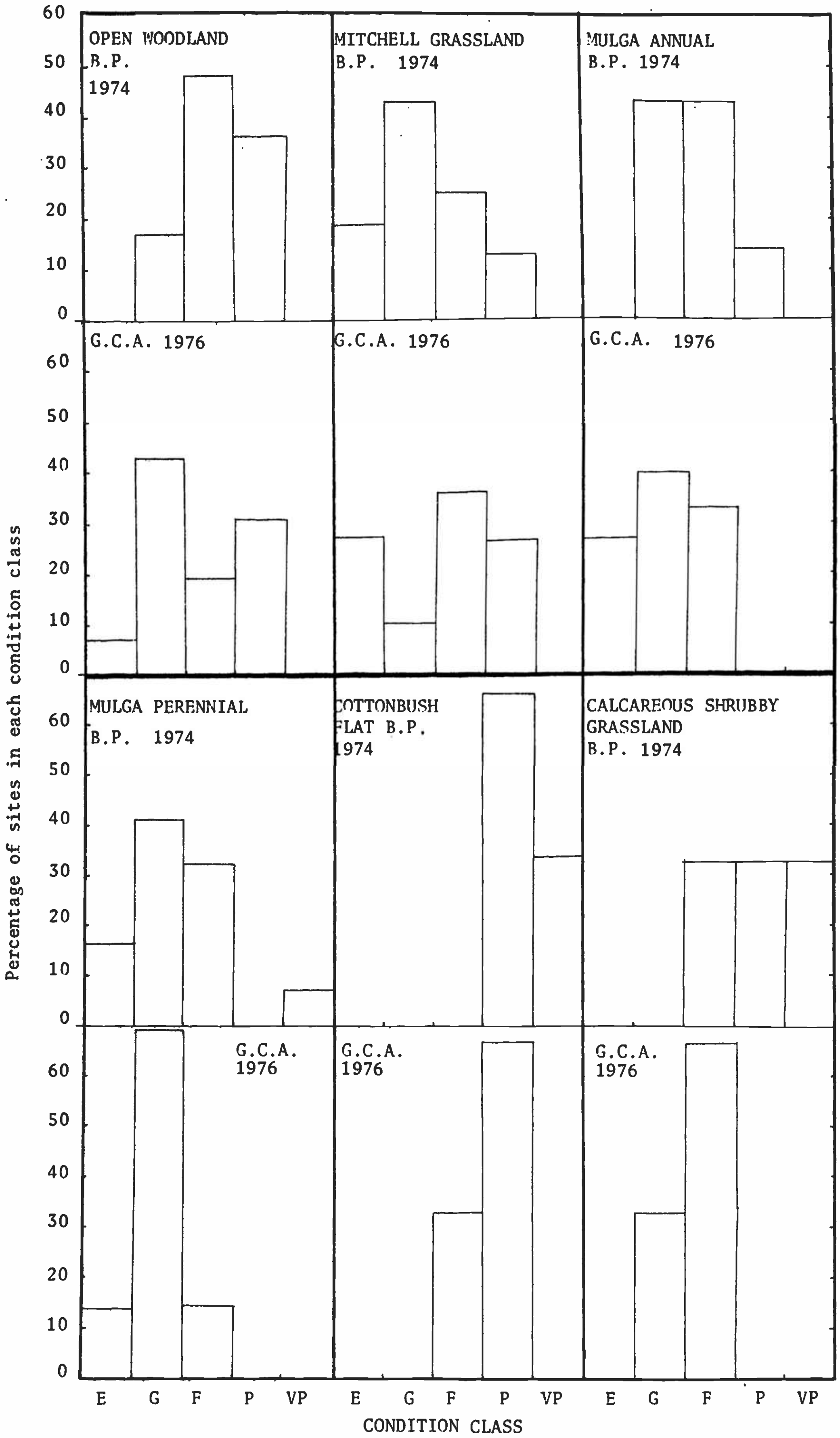
TABLE 2

The relationship between STARC score and distance from watering point (km) for the 1974 Burt Plain and 1976 Grazing Capacity Assessment Surveys.

Survey	Rangeland Type	Corr. Coeff.	F Test	Sig. of Reg.	Regression Equation
B.P.	All types & all sites	.10	.59	N.S.	-
	Open Woodland	.18	.79	N.S.	-
	Mitchell Grass	-.25	.89	N.S.	-
	Mulga-annual Understorey	.12	.06	N.S.	-
	Mulga-perennial Understorey	.27	.79	N.S.	-
	Cottonbush Floodout	-.19	.17	N.S.	-
G.C.A.	All types and all sites	.26	3.68	N.S.	-
	Open Woodland	.52	5.14	*	STARC=29.2 + 8.0 (km).
	Mitchell Grass	.21	.43	N.S.	-
	Mulga-annual under-storey	.34	1.68	N.S.	-
	Mulga-perennial Understorey	-.72	5.33	N.S.	-
	Cottonbush Flood-out	-.95*	8.33	N.S.	-

N.S. Not Significent at 5% or 1% level.

* Significent at 5% level.



E=Excellent 80-100; G=Good 60-79; F=Fair 40-59; P=Poor 20-39; VP=Very Poor 0-19.

Fig. 1

Percentage distribution of assessment sites into condition classes for six rangeland types in the 1974 Burt Plain (B.P.) Survey and the 1976 Grazing Capacity Assessment Survey (G.C.A.).