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

Copyright and Photocopying

Form of Reference

The reference for this article should be in this general form;

Author family name, initials (year). Title. *In*: Proceedings of the nth Australian Rangeland Society Biennial Conference. Pages. (Australian Rangeland Society: Australia).

For example:

Anderson, L., van Klinken, R. D., and Shepherd, D. (2008). Aerially surveying Mesquite *(Prosopis* spp.) in the Pilbara. *In*: 'A Climate of Change in the Rangelands. Proceedings of the 15th Australian Rangeland Society Biennial Conference'. (Ed. D. Orr) 4 pages. (Australian Rangeland Society: Australia).

Disclaimer

The Australian Rangeland Society and Editors cannot be held responsible for errors or any consequences arising from the use of information obtained in this article or in the Proceedings of the Australian Rangeland Society Biennial Conferences. The views and opinions expressed do not necessarily reflect those of the Australian Rangeland Society and Editors, neither does the publication of advertisements constitute any endorsement by the Australian Rangeland Society and Editors of the products advertised.

The Australian Rangeland Society

Paper presented to Australian Rangeland Society, Broken Hill July, 1977

Survey of paddock size and stock water supplies in the western Riverina district of New South Wales

V. R. Squires

CSIRO, P.O. Box 77,
Alice Springs, N.T. 5750

Abstract

In order to assess the current level of stock watering facilities on pastoral properties within the western Riverina, and to relate this information to paddock size and vegetation type, large areas of land (785,000 ha) within the region were surveyed. Paddock boundaries and the location of watering points were plotted. Watering points were classified as to type.

Mean size of paddocks was related to vegetation type. On the degraded grasslands in the eastern part of the study area the mean paddock size was 746 ha. Paddock size in the chenopod shrublands averaged 780 ha. In the Mallee-dominated areas mean paddock size was 1,553 ha.

The number of permanent watering points per paddock varied from one to four. Less than half the paddocks (43%) had fresh water available as an alternative to the saline ground waters generally available from sub-artesian bores.

Almost half the paddocks (47%) were sufficiently large, or the watering points so positioned, that the sheep would need to walk 3km or more to reach the most remote part of the paddock at seasons of the year when temporary waters had dried up. Overall 18% of the land in the non-mallee areas lay beyond a 3 km radius of permanent water.

The management implications are discussed.

I. INTRODUCTION

Livestock grazing is the principal form of land use over much of the semi-arid western Riverina in south-west N.S.W. (Leigh and Noble, 1972). Knowledge of the conditions under which livestock are raised commercially is a prerequisite to the study of management options. Management is often severely constrained by the location of fences and watering points.

The relationship of paddock size to watering point distribution has been shown (Squires and Hindley, 1970) to be an important one. The ability of sheep to walk long distances to water has been assessed (Squires, Wilson and Daws, 1972) and it can be concluded that land lying beyond a radius of about 3 km from water is likely to be outside the range of sheep grazing a saline pasture such as saltbush in summer (Squires, 1976).

As part of any overall inventory of rangeland resources in western N.S.W. we need to know the size of paddocks, the distance between watering points, the proportion of each paddock (expressed as a percentage of the total paddock area) effectively served by watering points, and the permanency of water points. Furthermore we need to assess the influence of vegetation type on these factors.

The aim of the work reported here was to assess the current level of stock watering facilities on pastoral properties within the western Riverina and to relate this information to paddock size and vegetation type.

II. METHOD

Location

The survey area included part of the Riverine Plain. In broad terms the vegetation formations (Figure 1) progress from dry sclerophyll forest at the eastern margin through savannah woodland to shrub steppe and mallee in the west (Leigh and Noble, 1972).

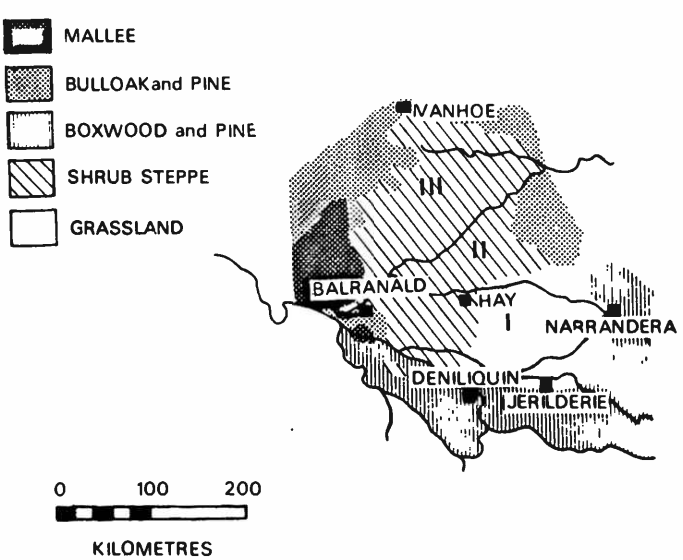

Figure 1. Locality map showing the survey area and Zones I, II and III. The broad pattern of vegetation is indicated.

The survey was limited to properties north and west of Deniliquin where irrigation development was not a complicating factor and where there was no river frontage. Three zones were recognised within the survey area (Figure 1). The area between the Billabong Creek and the Murrumbidgee River was designated Zone 1 and was the subject of an earlier survey reported by Squires and Hindley (1970). Zone II includes the area between the Murrumbidgee and the Lachlan Rivers and Zone III is the land lying north of the Lachlan River within the boundaries of the Balranald Shire.

Procedure

Two separate procedures were employed to collect information on paddock size and location of watering points. In the area between the Murrumbidgee and the Lachlan rivers (Zone II in Fig. 1) the survey depended on a combination of aerial photo interpretation and spot checks for ground truth along a transect. A technique involving the use of small scale (1:30,000) aerial photography was developed (Squires and Hindley, 1971). Aerial photographs were obtained on loan from the N.S.W. Department of Lands and paddock boundaries were traced from them. The watering points were located and classified as to type. Two principal types of water developments were recognised a) excavated ground tanks and b) sub-artesian bores. In some paddocks there were wells.

For land lying north-west of the Lachlan river (Zone III in Fig. 1) a postal questionnaire was conducted. A copy of their property outlines (drawn to scale) was sent to 180 land holders along with a request that they fill in the paddock boundaries and show the location of each watering point. A questionnaire was enclosed and additional information on vegetation, water quality, and permanency of surface waters was sought.

The major parameters considered were paddock size, number of watering points per paddock, position of watering points, area of land lying within a 3 km radius of a watering point, maximum distance from water in any given paddock, salinity of bore waters,permanency of ground tanks, and dominant vegetation type in each paddock.

III RESULTS

Zone 1

The results from this zone were presented in detail in Squires and Hindley (1970) but are summarized here for the convenience of the reader. Mean paddock size was 883 ha with a modal size of 708 ha. Over 48% of the total land area surveyed (100,000 ha) lay beyond a 2.4 km radius of permanent water while the maximum distance to water exceeded 3.2 km in 45.4% of the 114 paddocks surveyed.

Zone 11

The area between the Murrumbidgee and the Lachlan rivers is made up of two major vegetation alliances (Leigh and Noble, 1972). The Eastern section which extends from a point just west of Narranderra to a line approximately defined by the Cobb Highway linking Deniliquin and Hay (see fig. 1) is predominantly a disclimax community in which the principal species are the perennial grasses Danthonia caespitosa (white top) and Stipa variabilis (variable spear grass). The area west of the highway and extending to Balranald is an Atriplex vesicaria (bladder saltbush) alliance. The results for each region were analysed separately.

Eastern region: Paddocks of less than 100 ha in area were not included in the analysis. These paddocks were generally holding areas associated with stock yards,

shearing sheds or homesteads. Of the remainder, 102 paddocks were analysed. The mean paddock size was 746 ha (range 125-3470 ha) with a modal size of 671ha. The maximum number of watering points (bores or large excavated tanks) in each paddock was four, although several small excavated tanks provided water in the cooler months (June-October). The most common position was in the corners of paddocks (so that each served more than one paddock) or at sites along the fencelines at the midpoint of paddocks. Most ground tanks in this region are 'permanent' because run-off water is supplemented in many areas by irrigation drainage waters which are derived from the nearby Murrumbidgee Irrigation Area and other local irrigation schemes.

Bore water salinity was tested from 10 bores within the region as part of the ground truth collection. Salinities ranged from 0.2% to 0.7% total soluble salts. It was uncommon for bore water to be the only source of water in a paddock. Over half (54%) of the paddocks had fresh water available all or almost all of the year.

The maximum distance from the watering point to the most remote part of the paddock exceeded 3 km in only eight of the paddocks surveyed while in three paddocks the distance exceeded 4km. On average only 10.7% of the land area lay beyond a 3 km radius of water.

Western region: Excluding the small paddocks of <100 ha there were 223 with an average size of 780 ha (range 103-2845 ha). The modal size was 673 ha. The average number of watering points per paddock was only two in this region and a higher proportion of them were bores. Again the placement was either in a corner or on the midline of a subdivision fence.

Fewer paddocks (37%) provided alternative fresh water sources than in the eastern region. Ground tanks were generally larger with many exceeding 10,000 m^3 in capacity. Water from drainage of irrigation areas was not available and many tanks did not provide water on a year-long basis unless capacity was in excess of about 10,000 m^3.

The maximum distance from the wateringpoint to the most remote part of the paddock was 3 km in 41 of the paddocks and >4 km in 21 of them. On an area basis, 27.8% of the land lay outside a 3 km radius of water.

Zone III

Almost all of the land surveyed in this zone is within the boundaries of the Balranald Shire.

Vegetation within the Zone III was more variable than in other Zones. In the eastern region the predominant vegetation was A. vesicaria while in some localised areas bluebush (Maireana pyramidata) was dominant. On the north and west margins of the Zone mallee (Eucalyptus oleosa, E. dumosa) predominated. Because of the information supplied by the landholders on a paddock by paddock basis I was able to derive a relationship between vegetation type and paddock size in Zone III. In genera paddocks were larger in Zone III irrespective of vegetation type but paddocks within the mallee-dominated areas were larger (1230-6800 ha) than those dominated by

chenopods (374-1276 ha). Of the 286 paddocks surveyed in Zone III the mean size was 1553 ha (range 374-7760 ha) with a modal size of 1847 ha.

There were marked differences in the number of watering points per paddock in the mallee areas of the Zone and those areas dominated by chenopods. On average each paddock in the saltbush areas had 3.5 waters while in the bluebush dominated areas there were two. Mallee areas usually only had one and quite commonly it was an excavated tank of large capacity. There were more small-capacity (temporary) water points among the gently undulating mallee areas but the sandy soils and the poor water holding capacity of the subsoils made long term storage difficult.

The maximum distance to water in a paddock was a variable parameter. In the chenopod-dominated areas the distance was > 3 km in only a few (12.7%) paddocks and, on an area basis, this represented 17.4% of the total land area. Distances to 'permanent' water in mallee-areas exceeded 7 km in 42% of paddocks. It seems clear that temporary waters provided livestock access to these paddocks on a seasonal basis only.

Information on bore water salinity, as supplied by the landholders, shows that in general the deeper bores had better quality water and that salinity increased to the west. In the mallee areas subartesian bores are less common and more reliance is placed on excavated tanks. Here sandy soils of high permeability create problems for siting tanks and the most successful tanks are those on a rocky bottom or where crystalline gypsum outcrops occur. Many (32%) paddocks were not supplied with permanent water and livestock grazing is confined to the cooler months when surface water is available in temporary storages and when stock water demands are low.

There were 169 watering points in Zone III of which 106 (62%) were ground tanks, 43 (25.4%) were bores, and 21 (12.5%) were wells. Ground tanks varied in size from 2500 m^3 to about 40,000 m^3. The modal size was in the range 5000-7000 m^3. The 43 bores varied considerably in depth from < 15 m to > 140 m with a modal value of 45 m The deepest bore was 233 m. For the 23 bores in which depth to water was known, the modal value was 6-7 m (range 4.9-31.6m). Wells were generally shallow (12-15 m) although four wells were > 33 m deep. Most watering points were established > 30 years before the survey began. No new wells have been dug since 1914.

IV. DISCUSSION AND CONCLUSIONS

The survey involved 612 individual paddocks and covered an area of 785,418 ha. Property size, among those properties surveyed, ranged from 3127 to 42817 ha. The mean size was 12578 ha. The average number of paddocks per property was 7.1 (range 2-13). Paddocks of 100 ha are not considered in this assessment. By comparison with the central Riverine Plain (Zone 1, Fig. 1) surveyed earlier by Squires and Hindley (1970), the northern Riverine Plain has fewer watering facilities. Almost half of the paddocks (47%) were sufficiently large, or the watering points were so positioned, that sheep would need to walk 3 km or more to reach the most remote part of the paddock at seasons of the year when temporary waters had dried up.

Overall only 18.6% of the land within Zone II lay beyond a 3 km radius of permanent water. The figure was similar for the chenopod areas of Zone III. The mallee areas (off the Riverine Plain) were less well served by permanent waters and the proportion of land lying beyond a 3 km radius was in excess of 35%.

Information on bore water salinity was derived from a number of sources, including previously published information. These results indicated that much of the water was close to the salinity limit which is tolerable for sheep grazing saltbush dominated pastures (Wilson, 1975). The tendency for salinity to increase from east to west which was first reported by Jones, Leigh and Mulham (1968) is supported by the results from this survey. Less than half of the paddocks (43%) had fresh water available as an alternative to the saline ground waters and of these not all were available on a year-long basis.

Paddock size was generally similar in both Zones I and II and in the non-mallee areas of Zone III. Paddock size once determined is not easily altered. Unless a fire removes a fence the next unit of subdivision is to split the paddock in half. This may provide a second best approximation to optimum paddock size given the objective of maximum pasture utilization. Subdivision allows greater control of livestock, but also decreases the size of the management unit which increases costs. Better utilization of pastures via subdivision would normally require additional water points. These additional costs must be offset by the increased returns which would result from better management and greater utilization. The relationship between paddock size and vegetation type noted in Zone III suggests that these trade offs are very real considerations to the grazier, as he tries to balance pasture productivity, carrying capacity and flock size.

Information on the optimum spacing of wateringpoints has come from studies of sheep behaviour (Squires, Wilson and Daws, 1972; Squires, 1976) which suggest that the grazing range of sheep is dependent on breed, age, and physiological status of the sheep and the type of pasture on which they are confined. For Merino sheep on saltbush drinking once daily a grazing range of 7 km might be reasonable. In the light of this survey, where only 18% of the land lay beyond a 3 km radius of permanent water, the majority of the land area could be used in all seasons. In wet years the additional 18% could be utilized. It is likely though that some sheep would reduce drinking frequency to less than once daily (Squires and Wilson, 1971) and could utilize the far reaches of the paddocks in all but the driest seasons.

We might conclude then that the region is adequately watered. It is unlikely to be economic to supply permanent waters to the mallee country. In some paddocks where there is a large proportion beyond a 3 km radius of water extra water points might be justified but there is clear need to cost it out in the light of the behavioural considerations outlined above.

VI. REFERENCES

Jones, R. M., Leigh J. H. and Mulham, W. E. 1968. Preliminary evaluation of bore water in relation to sheep tolerance in the central Riverine Plain. Fld. Sta. Rec. Div. Pl. Ind., CSIRO (Aust) 7:95-104.

Leigh, J. H. and Noble, J. C. 1972 Riverine Plain of New South Wales: its pastoral and irrigation development. CSIRO Div. Plant Industry, Canberra.

Squires, V. R. 1976. Walking, watering and grazing behaviour of Merino sheep on two semi-arid rangelands in south-west New South Wales. Aust. Rangel. J. 1:13-23

Squires, V. R. and Hindley, N. L. 1970. Paddock size and location of watering points as factors in drought survival of sheep on the central Riverine Plain. Wool Tech. Sheep Breed 17(11):49-54

Squires, V. R. and Hindley, N. L. 1971. Small scale aerial photography as a tool in surveys of stock-watering points in a semi-arid region. Photo Interpretation 1971-2 (7):43-49.

Squires, V. R. and Wilson, A. D. 1971. Distance between food and water and its effect on drinking frequency, and food and water intake of Merino and Border Leicester sheep. Aust. J. Agric. Res. 22:283-290

Squires, V. R., Wilson, A. D. and Daws, G. T. 1972. Comparisons of the walking behaviour of some Australian Sheep. Proc. Aust. Soc. Anim. Prod. 9:376-80.

Wilson, A. D. 1975. Influence of water salinity on sheep performance while grazing on natural grassland and saltbush pastures. Aust. J. Exp. Agric. Anim. Husb. 15:760-765.