

The Behaviour of Free-ranging Cattle on an Alpine Range in Australia

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Abstract

The behaviour of free-ranging cattle on the Bogong High Plains, Victoria, was investigated during 2 summer grazing seasons. The main influence on cattle distribution was found to be their preferences for particular vegetation communities. Cattle preferred to graze in grassland and closed heathland and avoided mossbeds. Cattle preferred to rest on grassland, wet grassland, and at cattle camps. The interaction of cattle with mossbeds, the vegetation community most susceptible to disturbance, was investigated in detail. Cattle visited mossbeds primarily to drink, although a small number of animals entered them to graze.

The Bogong High Plains is the largest alpine plateau in Victoria, located 250 km northeast of Melbourne. The High Plains cover an area of some 70 km² above the tree-line and range in elevation from 1,660 m to 1,880 m A.S.L. The vegetation consists primarily of alpine tussock grassland, heathland, and mossbeds. The vegetation of the High Plains has been described by Carr and Turner (1959) and McDougall (1982).

The area is public land managed by the State Electricity Commission (SEC), Soil Conservation Authority (SCA) and the National Parks Service. In economic terms the most important value of the High Plains is a water catchment for the SEC Klewa hydro-electric scheme. The average annual precipitation is 2,555 mm, most of which falls as snow between June and October. Stock have grazed the High Plains during the summer months since 1852. The SCA has control over stock grazing on the High Plains, and today some 20 graziers hold annually renewable licenses to graze 4,000 cows with calves (primarily Hereford and Angus) from mid December until early April. There are no fences on the High Plains and cattle movements are unrestricted.

Previous vegetation studies of Australian alpine areas have indicated that the presence of stock and "burning-off" to improve stock feed have a deleterious effect on the fragile alpine ecosystem (Carr and Turner 1959, Wimbush and Costin 1979). The mossbed community, because of its soft, wet soils, appears to be the most sensitive vegetation community and may be more susceptible to

disturbances through grazing and trampling by stock. Costin (1958) reported heavy overgrazing of mossbeds by stock on Mt. Kosciusko, and Carr (1977) reported from the High Plains that a mossbed fenced since 1945 had increased in size and wetness, but that comparable mossbeds in grazed areas showed no signs of improvement. Costin et al. (1959) postulate that trampling in mossbeds leads to a breakdown of the internal drainage system, which in turn leads to a lowering of the water table with a consequent general drying out of the moss and peat, eventually reducing the size of the mossbed. It is essential to maintain the mossbeds in good condition to ensure that the optimum water catchment potential of the High Plains is realized.

This paper deals with the behaviour and movements of cattle on the Bogong High Plains, with particular attention given to the interaction of cattle with mossbeds.

Methods

Vegetation of the Study Areas

Two study areas were selected on the criterion that the major vegetation communities present on the High Plains were well represented. The study areas covered about 150 ha at Nelse (37° 51' S, 147° 20' E) and about 110 ha at Cope Creek (37° 55' S, 147° 17' E). The vegetation of the study areas was sampled using the quadrat method. Each vascular plant species in a 5 × 4-m quadrat was recorded and assigned a quantitative estimate of cover and abundance using a scale similar to that designed by Braun-Blanquet (1932). The locality of each quadrat was plotted on colour aerial photographs.

The quadrat data were analysed by computer using a procedure outlined by Gullan (1978). The result of this analysis was a two-way table which delineated the quadrats and species which formed vegetation communities. With the use of the aerial photographs, vegetation maps of the 2 study areas were prepared, and the percentage area covered by each vegetation community was calculated using a Summagraphics Intelligent Digitizer.

Behaviour of Cattle

The behaviour of free-ranging cattle was observed in the 2 study areas during 2 summer grazing seasons, 1980/81 and 1981/82. Cattle movements and utilization of vegetation communities were recorded using a scan sampling technique (Altmann 1974). Systematic scans of the study area were made every 5 minutes over a 2-hour period until a continuous series of observations from dawn

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till dusk had been accumulated over 2 or 3 consecutive days. At each scan, the activity (grazing, standing head raised, lying, walking, and drinking), the vegetation community occupied, and the distance to the nearest neighbouring cow were recorded for up to 20 individuals. During each season a total of some 27,000 observations of cattle were recorded during 11 dawn till dusk sessions.

The scan data were analysed by computer into cross tabulations of nearest neighbour distance by activity and vegetation community, and activity by vegetation community. In the analysis of time of day data the effect of different day lengths during the season was removed by transforming all times to sun angles, starting at sunrise, for each of the 11 observation sessions. Cattle preferences for particular vegetation communities were determined by comparing the actual number of observations of an activity against the expected number of observations using a $1 \times 2 \times 2$ test. The expected values were calculated on the hypothesis that if cattle utilized the vegetation communities randomly the occupation of each vegetation community must correspond to the percentage area covered by that community in the study area.

During the 1981/82 season additional detailed observations were made of cattle in mossbeds while the scan data were being collected. Cows entering a mossbed were observed continuously and their behaviour and movements were noted.

On 4 occasions during the 1981/82 season a cow with calf was followed on foot for a 24-hour period starting at sunrise. The location, activity and vegetation community occupied by the cow were continuously recorded. During the night a spotlight was used occasionally to aid observations. Periodic checks of other cattle were also made during the 24-hour period to ensure that the behaviour of the observed cow was similar to that of other animals in the group.

Results

Vegetation of the Study Areas

Five major vegetation communities and 4 minor communities were recognized. The percentage area of the 5 major vegetation communities in each study area is shown in Table 1. The well drained hillsides of the study areas support the grassland community, dominated by the fine-leaved snowgrass tussock *Poa hiemata*. Interspersed between the tussocks grow a variety of herbs which in some areas form the dominant cover. The dominant herbs are the silver snow daisy, *Celmisia asteliifolia* and scaly buttons, *Leptorhynchos squamatus*. Bareground is very common between snowgrass tussocks and none of the grassland quadrats sampled resembled the grassland in climax condition as described by Carr and Turner (1959). Carr (1962) is of the opinion that stock grazing and the wild fires of 1939 have led to an opening up of the grassland, and that shrubs are most efficient in colonizing the resulting bare ground. The increasing shrub cover has led to an increase of the open-heathland community, where the dominant shrubs are alpine grevillea, *Grevillea australis*, and rusty pods, *Hovea longifolia*. On steeper exposed slopes and areas with shallow soils, closed-heathland forms a dense cover of shrubs. Ledge grass, *Poa hothamensis*, is a common component of this community. On more water-logged soils a coarser species of snow grass, *P. costiniana*, and the rush, *Empodisma minus*, are co-dominants of the wet-

Table 1. Percentage area covered by vegetation communities in the Cope Creek and Nelse study areas.

Vegetation community	% Area	
	Cope Creek	Nelse
Grassland	34.0	21.4
Open heathland	29.4	22.5
Closed heathland	4.6	42.4
Wet grassland	11.0	2.9
Mossbed	18.2	9.0
Other	2.8	1.8

grassland community. Extensive mossbeds have formed along drainage lines, dominated by the moss, *Sphagnum cristatum*, heath species such as *Epacris glacialis* and the sedge *Carex gaudichaudiana*.

Behaviour of Cattle

Cattle in the study areas grazed in small groups of 6–12 animals. The cattle in these groups were very close together, with individuals less than 5 m apart in 50% of all grazing observations (Fig. 1). Resting behaviour (standing, head raised and lying) was observed in larger groups with greater numbers of individuals close together, and 65% of individuals were less than 5 m apart (Fig. 1).

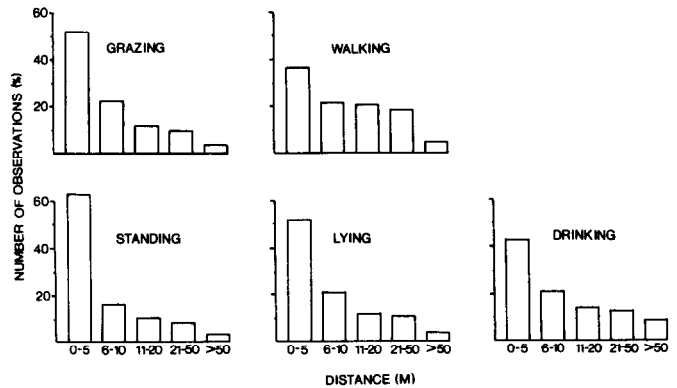


Fig. 1. Frequency distributions of nearest neighbour distances for different activities.

Variation in spatial behaviour in the vegetation communities was related to the cattle's activities. In the communities where cattle grazed for a significant part of the day (grassland, open and closed heathlands) the cattle were spaced further apart than in communities such as cattle camps where cattle primarily rested (Fig. 2).

The diurnal activity pattern of the cattle was similar in both years. Around sunrise cattle started an intensive grazing period which lasted 4 to 5 hours. This was followed by a siesta around midday, intermittent grazing in the afternoon, and another intensive grazing period in the late afternoon (Fig. 3). The diurnal activity pattern was not related to the utilization of particular vegetation communities, except for cattle camps, which were used more during the midday hours than during the rest of the day.

The grazing behaviour of cattle in each vegetation community is shown in Table 2. At Cope Creek in both seasons cattle preferred to graze in grassland and closed heathland, while wet grassland and mossbed were not preferred. During the 1981/82 season cattle

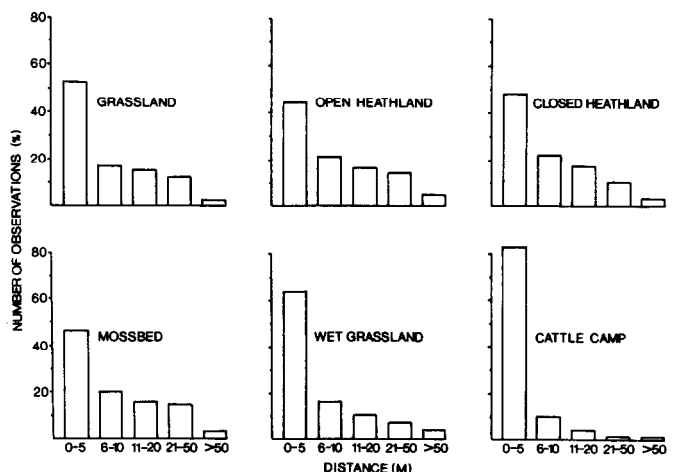


Fig. 2. Frequency distributions of nearest neighbour distances for different vegetation communities.

Table 2. Grazing behaviour in the Cope Creek and Nelse study areas during 1980/81 and 1981/82 seasons.

Vegetation community	Cope Creek			Nelse		
	Actual No. observations (%)		Expected No observations (%)	Actual No. observations (%)		Expected No. observations (%)
	1980/81	1981/82		1980/81	1981/82	
Grassland	56.0**	40.9**	34.0	30.7**	18.4**	21.4
Open heathland	24.3**	30.5*	29.4	24.3**	23.6*	22.5
Closed heathland	6.1**	10.4**	4.6	27.7**	41.8	42.4
Wet grassland	5.9**	6.3**	11.0	8.1**	4.0**	2.9
Mossbed	4.8**	6.2**	18.2	2.4**	3.0**	9.0
Other	2.9**	5.7**	2.8	6.8**	9.2**	1.8

** $P < 0.01$, * $P < 0.05$, χ^2 test, d.f. = 1

moved into open heathland and closed heathland at the expense of grassland. Grazing behaviour in the Nelse study area was similar to Cope Creek. Cattle showed a marked increase in preference for closed heathland during the 1981/82 season. Mossbed was not preferred for grazing during both seasons.

The resting behaviour of cattle in each vegetation community is shown in Table 3. Similar behaviour was observed in both study areas. Cattle preferred to rest in grassland, wet grassland (except

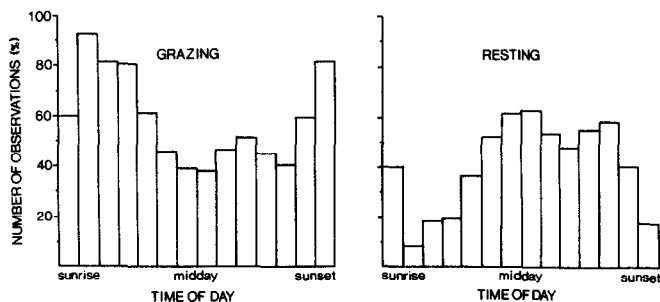


Fig. 3. Frequency distributions of grazing and resting behaviour during daylight hours.

Cope Creek in 1980/81), and cattle camps. Open heathland, closed heathland, and mossbed were not preferred for resting.

In both study areas a significant percentage of resting (6–22%) was at cattle camps. These camps were conspicuous rocky outcrops where cattlemen regularly salt their cattle. Even when no salt was given, large numbers (20–40 animals) congregated around these rocks during the midday resting period. The camps were not used as bedding grounds at night.

Ethograms of the behaviour patterns of 2 cows are shown in Figure 4. There was a marked increase in time spent grazing per 24-h day as the season progressed. The cow observed at the start of the season spent 7.3 h grazing, compared with 11.5 h for the cow at

the end of the season, of which 3.0 h was spent grazing at night. None of the cows observed spent any significant time in mossbeds, and used mossbeds always for drinking. These data support observations using the scan sampling technique.

The scan data suggest that cattle do not find mossbeds attractive

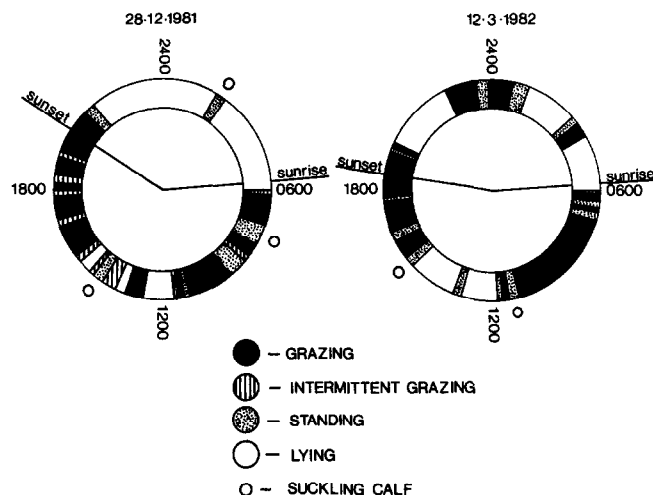


Fig. 4. Ethograms for behaviour patterns of a cow observed in a 24-h period at the start of the season (28/12/81) and the end of the season (12/3/82).

for grazing, but that this community provides the major source of drinking water (Table 4).

On 45 occasions the activities of individual cows in mossbeds were observed during the 1981/82 season (Table 5). The main impression formed from these observations was that cattle entered the mossbed to drink but often grazed on their way in and out. Of the 30 cattle that grazed in mossbeds, 22 also drank. Cattle that grazed and drank tended to graze for shorter periods (median 4.5

Table 3. Resting behaviour in the Cope Creek and Nelse study areas during the 1980/81 and 1981/82 seasons.

Vegetation community	Cope Creek			Nelse		
	Actual No. observations (%)		Expected No observations (%)	Actual No. observations (%)		Expected No. observations (%)
	1980/81	1981/82		1980/81	1981/82	
Grassland	58.4**	48.8**	34.0	22.6*	27.4**	21.4
Open heathland	13.28**	16.8**	29.4	11.2**	13.9**	22.5
Closed heathland	0.5**	0.5**	4.6	3.7**	6.5**	42.4
Wet grassland	10.0*	15.3**	11.0	25.9**	27.2**	2.9
Mossbed	5.0**	3.6**	18.2	5.6**	4.4**	9.0
Cattle camp	6.7**	6.1**	0.1	22.2**	17.3**	0.2
Other	6.2**	9.9**	2.7	8.8**	3.3**	1.6

** $P < 0.01$, * $P < 0.05$, χ^2 test, df = 1

Table 4. Behaviour of cattle in mossbeds in the Cope Creek and Nelse study areas, during the 1980/81 and 1981/82 seasons.

	Cope Creek		Nelse	
	1980//81	1981/82	1980/81	1981/82
No. of observations in mossbeds (%)	5.3	6.1	4.1	4.2
No. of grazing observations in mossbeds (%)	4.4	6.2	2.4	3.0
No. of drinking observations in mossbeds (%)	89.7	98.6	85.5	96.0

min, range 1–31 min) than cattle that grazed and did not drink (median 17.5 min, range 1–55 min, $p=0.08$, Mann-Whitney U test). Thus, there was a small number of individuals who appeared to enter mossbeds to graze.

Discussion

Previous studies have shown that the distribution of cattle on free-range is influenced by the type of vegetation, steepness of slope, roughness of terrain, and distance from water and salt (Cook 1966, Hodder and Low 1978, Low 1972, and Mueggler 1965). The vegetation of the Bogong High Plains formed a mosaic with all the major vegetation communities easily accessible. Therefore, distance and slope steepness did not affect selection of vegetation communities by cattle. The steepest slope in the study areas was 15°, but even steeper sections outside the study areas were accessible along one of the many cattle tracks which followed contour lines. We found that cattle grazed the preferred vegetation communities extensively regardless of the slope. Distance to water and salt were not restrictive influences as free-flowing water and salting areas were common in both study areas. Thus, the main factor affecting distribution of cattle on the High Plains was the preference of cattle for particular plant communities.

The behaviour of cattle has a strong influence on which vegetation communities were preferred. Cattle preferred to rest on grassland, wet grassland, and during the midday resting period, at cattle camps. Grazing cattle utilized vegetation communities in the 2 study areas to different extents, probably because of differences in availability of the communities rather than differences in plant composition. In both study areas grazing cattle preferred grassland; open heathland was not actively preferred (utilization was similar to availability) and mossbeds were avoided. Closed heathland was preferred in the Cope Creek area, but although the amount of time cattle grazed in closed heathland in the Nelse study area was high (up to 42%) it was not a preferred community because of its availability.

The selection of different vegetation communities by grazing cattle is dependent on the availability of palatable plants. Preliminary investigations into the diet of cattle on the High Plains (van Rees 1982) have shown that many of the plants regularly grazed by cattle are those plants common in grassland and closed heathland. Plants common in mossbeds were not regularly grazed by cattle.

Cattle on the High Plains exhibited the same diurnal pattern of behaviour as other grazing cattle (Arnold and Dudzinski 1978). There were 2 main grazing periods, in the morning and afternoon, with a resting period around midday. The 24-hour observations showed that when green feed was abundant at the beginning of the season total grazing time was short and there was no grazing at

Table 5. Frequency and median duration of activities observed in the visits of 45 cows to mossbeds. Ranges are shown in parentheses.

Activity	Frequency	Duration (min)
Grazing	30	5.5 (1–55)
Standing	18	2.0 (1–8)
Walking	33	1.0 (1–4)
Drinking	33	2.0 (1–6)

night. However, as the summer progressed and the vegetation dried out, cattle were grazing for longer periods including a 2- to 3-hour grazing period at night.

The interaction of cattle with mossbeds poses a threat to maintaining optimum water catchment conditions. Cattle primarily used this community for drinking, but a small number of individuals entered mossbeds with the sole intention of grazing. Mossbeds are easily disturbed through trampling, and this community should be closely monitored so that further deterioration does not occur.

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