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Response of Bonded and Non-bonded Sheep to the Approach of a Trained Border Collie

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ABSTRACT

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Intra- and interspecific association of cattle and bonded or non-bonded sheep was observed under free-ranging conditions preceding, during and following the approach of a trained border collie dog. A bonded sheep is one which consistently stays in close proximity to cattle as a result of a continuous close association between the two species, which began when the sheep was a young lamb. The dog treatment provided insight into the response of livestock to an aggressive, threatening canine. Sheep bonded to cattle remained together as one interspecific group when threatened by the dog. Interspecific space decreased and the sheep positioned themselves among the cattle and away from the dog. Cattle aggression, i.e. kicking and charging the dog, was only observed when the dog approached the heifers. Non-bonded sheep and cattle reacted as two distinctly independent intraspecific groups. The non-bonded sheep reduced their intraspecific space and moved away from the cattle when threatened by the dog. The protection that bonded sheep receive from cattle appears to result from the close association with the cattle, which poses a threat to predators.

INTRODUCTION

Multi-species grazing is ecologically sound (Stebbins, 1981) but often uneconomical because of predators (Merrill, 1985), especially coyotes (*Canis latrans*), which pose a serious threat to livestock production when vulnerable animal species are grazed singly or in combination in the western United States

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(Young and Jackson, 1978; Wade and Browns, 1982). Annual losses of lambs, ewes and calves in the 17 western states have been estimated to be 4–8, 1.5–2 and 0.4%, respectively (Black, 1982). Coyotes have been (Baker, 1944) and continue to be New Mexico's worst predator. In a survey conducted during 1972 and 1973, 99 New Mexico wool growers reported that 55% of their lamb losses were caused by coyotes (Howard and Shaw, 1978). Hulet et al. (1987b) indicated that 44% of the ewes released on the Jornada Experimental Range in 1983 were lost to coyote predation.

Reduced sheep losses due to predation have been reported where sheep and cattle are managed together under free-ranging conditions (Blackford, 1985; Umberger et al., 1985; Hulet et al., 1987a). However, the mechanism by which protection is realized has not been documented. R.H. Blackford (personal communication, 1986) indicated that the spatial pattern of sheep and cattle while at pasture plays a significant role; the closer the association the greater the degree of protection. We define a bonded sheep as one which consistently stays in close proximity to cattle as a result of continuous close association, starting when the lamb is young. The objective of this study was to document inter- and intraspecific spatial patterns of bonded vs. non-bonded sheep with cattle under free-ranging conditions preceding, during and following the approach of a trained border collie dog.

MATERIALS AND METHODS

The study was conducted between 2 and 9 December 1986, on the Jornada Experimental Range in south-central New Mexico, in 3 arid rangeland paddocks, 121, 243 and 405 ha in size. Herbaceous vegetation, primarily perennial grasses and annual forbs with a discontinuous overstory of woody shrubs, comprised the standing crop.

No rain was recorded during the field study. Clear skies characterized the initial and final test days, while 4 December was overcast with haze and 5 December was cloudy. Wet- and dry-bulb ambient air temperatures were recorded, along with wind speed and direction. Ambient air temperatures were typical of long-term averages, ranging between 3 and 15 °C. Morning, midday and afternoon relative humidities averaged 57, 33 and 31%, respectively. Wind velocities ranged between 0 and 16 km h^{-1}.

Before December, the livestock had been maintained on arid rangeland paddocks. Forty-eight sheep (all of similar age) and 17 heifers (Brangus and Hereford × Angus genotypes) were used. The sheep were cross-bred Rambouillet × Polypay of two ages, 36 yearling and 12 mature ewes. Only 12 of the yearling ewes had previously been bonded, beginning between 45 and 90 days of age, by being confined to pens averaging 139 m^2 for 60 consecutive days (Anderson et al., 1987). These sheep remained together with the heifers under free-ranging conditions. The remaining 36 sheep had not been in visual contact with cattle before this study and did not stay close to the heifers. The bonded sheep/cattle group was called a flerd. Flerd is a contraction of flock and herd, and is defined in this manuscript to designate a group of sheep that have bonded to cattle to form a multi-species unit.

Six livestock combinations were evaluated: (1) 12 bonded yearling ewes and 6 heifers (flerd); (2) 12 non-bonded yearling ewes and 6 heifers (control); (3) 24 yearling ewes and 12 heifers (flerd+control); (4) 12 non-bonded yearling ewes (sheep only); (5) 6 heifers (heifers only); (6) 12 non-bonded mature ewes and 6 heifers (ewes+heifers). The same heifers were used to test livestock combinations (5) and (6). To evaluate if non-bonded mature ewes would react in a similar manner to non-bonded yearling ewes, the two age groups were tested. To determine the extent to which bonded sheep control the movement of non-bonded sheep, a ratio of 1:1 bonded to non-bonded yearling ewes, in the presence of heifers, was tested. Previous research demonstrated that bonded sheep, in the presence of cattle, control the movement of non-bonded sheep when in a ratio of 1:1 (Anderson et al., 1987). Each of the 6 livestock combinations was assigned randomly to 1 of 3 paddocks. Livestock combinations (1), (2) and (5) were tested on 2 and 4 December and the remaining 3 livestock combinations were tested 5 and 9 December. Over the 4 days of testing, 2 observers evaluated each of the 6 livestock combinations during a morning, midday and afternoon period.

The treatment consisted of sending a 6-year-old female border collie dog, trained to work cattle and sheep, into each of the 6 livestock combinations. The dog was trained to move the livestock in response to voice and hand signals. The data consisted of estimates, in meters, of the diameter of the smallest circular area that would enclose all sheep, cattle and sheep plus cattle, in addition to the shortest distance between the perimeter of the ovine and bovine areas. These estimates were made at a distance of between 100 and 200 m from the animals. In addition to the estimated distances, video information was obtained using a camcorder with a 1–6 zoom lens[1].

Pre-treatment observations were made before sending the dog (treatment) into the livestock. Paddock size had no influence on interspecific distances because the sheep and cattle composing the flerd were always together, while the non-bonded sheep in livestock combinations (2) and (6) were never with the heifers. When the sheep and cattle were widely separated they were brought together, followed immediately by application of the treatment. The interspecific separation before the treatment was applied was never greater than 75 m.

The response of the livestock to the presence of the dog was evaluated during time-intervals that lasted 2–5 min, during which time the dog was under the control of the handler. As the dog brought the livestock to within 30 m of the

[1]A research video was prepared and is available for a nominal fee from the Jornada Experimental Range; (Box 30003-NMSU, Las Cruces, NM 88003-0003, U.S.A.) (13 min VHS video tape with sound).

observers, the treatment was terminated. Post-observation data were taken for 3 min after the treatment ended.

The data were largely descriptive. However, estimated distances were summarized. Data collected by the 2 observers were averaged before calculating a raw mean and standard deviation for each of the 6 livestock combinations.

RESULTS

The flerd of bonded yearling ewes and heifers was always found together prior to applying the treatment (dog). The non-bonded sheep, regardless of age, were never closer than 150 m before application of the treatment, and were often separated by > 161 m, which meant they had to be brought to within 75 m of the heifers before the treatment could be applied. Non-bonded sheep moved independently of the cattle in every test, and soon were widely separated from them. However, when non-bonded yearling ewes in a 1:1 ratio with bonded yearling ewes were in the presence of cattle, the movement of the bonded sheep controlled the movement of the non-bonded sheep. During the test, as soon as the sheep were threatened, they bunched together in the middle of the cattle and maintained that position, whether moving or stationary, until the threat ended. Therefore, the cattle were almost always observed between the sheep and the dog. With few exceptions, the sheep stayed within a perimeter formed by the cattle.

Overall, the sheep maintained smaller-diameter areas (6 ± 2–92 ± 59 m) compared to the cattle (13 ± 2–126 ± 69 m), regardless of livestock combination. In general, the sheep and cattle each occupied less area in the presence of the dog compared to pre- and post-treatment periods. The mean minimum diameter area occupied by the livestock during application of the treatment was smaller compared to pre- and post-treatment areas except for the area occupied by the heifers in the control group and the sheep in the group containing non-bonded mature ewes (Table 1). Except for the non-bonded yearling ewes and heifers, in which the smallest area occupied by the livestock preceeded treatment, the mean minimum-diameter area occupied by both sheep and cattle was greater in size preceeding and following the application of the treatment than during treatment application, with during < following < preceeding (Table 2). Throughout the study the flerd occupied a smaller area pre- , post- and during application of the treatment than did the other 3 interspecific livestock combinations (Table 2).

The video-tape documentation supported the inter- and intraspecific estimated distances. The cattle were observed to kick at the dog during several tests when the sheep stayed with the cattle. As the livestock groups containing both sheep and cattle were herded together by the dog, the livestock stopped moving and the cattle would face the dog. The bonded yearling ewes in the flerd and flerd plus non-bonded yearling ewes were intermingled among the

TABLE 1

Mean minimum diameters (m) and standard deviations of areas which would enclose all animals within a species preceeding, during and following exposure of 6 livestock combinations to a trained border collie dog

	Livestock combinations					
	Non-bonded yearling ewes plus heifers (control)	Bonded yearling ewes plus heifers (flerd)	Control plus flerd	Non-bonded mature ewes plus heifers	Non-bonded yearling ewes only	Heifers only
Sheep						
Preceeding	16±14	32±31	92±59	10± 5	7±3	
During	6± 4	9± 2	19± 9	6± 2	6±3	
Following	11± 5	19±14	30±20	6± 2	8±4	
Cattle						
Preceeding	40±27	45±29	126±69	29±20		96±64
During	49±30	15± 6	41±20	22±11		13± 2
Following	33±21	38±32	55±45	38±36		37±48

TABLE 2

Mean minimum diameters (m) and standard deviations of area which would enclose both cattle and sheep preceeding, during and following exposure of 4 livestock combinations to a trained border collie dog

	Livestock combinations[1]			
	Non-bonded yearling ewes plus heifers (control)	Bonded yearling ewes plus heifers (flerd)	Control plus flerd	Non-bonded mature ewes plus heifers
Preceeding	88±23	46±27	118±48	308±154
During	132±35	16± 6	45±25	80± 24
Following	194±80	41±30	51±30	152± 0

[1]Before the start of the trial, non-bonded yearling ewes and non-bonded mature ewes were great distances from the cattle. Therefore, pre-treatment diameters reflect that the control sheep were driven to within a short distance of the cattle before each trial was started.

cattle. The heifers in this livestock group appeared to shield the yearling ewes from the dog. In contrast to these 2 unified groups, the non-bonded yearling ewes and non-bonded mature ewes were separated by between 121±41 and 93–47 m, respectively, from the heifers when the dog was present. Pre-treatment distances of separation were meaningful in the non-bonded yearling ewe–heifer group and non-bonded mature ewe–heifer group because the two animal species had to be brought together before application of the treatment. In the majority of the tests involving non-bonded sheep, the dog would approach the sheep first in an attempt to herd them towards the heifers. The sheep showed no affinity for the cattle, and immediately following treatment, the non-bonded yearling ewes and heifers and non -bonded mature ewes and heifers were separated by 197 ± 105 and 264 ± 81 m, respectively. The video-tape of these non-bonded groups showed two species of livestock that did not associate and were completely independent in their movement patterns.

DISCUSSION

The smaller physical size of sheep compared to cattle, and the unique spatial distribution patterns exhibited by the two species under free-ranging conditions (i.e. stronger flocking behavior of sheep), resulted in the smaller-diameter areas occupied by sheep compared to cattle. As the dog approached the mixed-species groups containing bonded yearling ewes, the inter- and intra-species space decreased and the cattle were seen kicking at the dog. As the flerd walked away from the dog, the bonded sheep occupied the intraspecific space among the cattle. When the flerd stopped, the cattle would frequently face the dog. This provided a perimeter of cattle between the sheep and the dog. The dog consistently stayed several meters away from the flerd. The sheep running into the middle of the cattle when threatened, resulting in a perimeter of cattle, appears to provide the defense mechanism necessary to give sheep protection from predators.

In the test of the livestock combinations containing non-bonded sheep and cattle, the dog was directed to bring the two species together and then move them as a single group toward the observers. In contrast to the sheep in the flerd, the non-bonded yearling and non-bonded mature ewes reduced their intraspecific separation, but moved independently of the cattle. Two separate and distinctly independent intraspecific groups were formed. As the dog approached the sheep, they would bunch together and move around and through the cattle. Once separated from the cattle, the non-bonded sheep were moved by the dog towards the observers. Had the dog been a coyote, any of the sheep would have been easy prey.

Cattle demonstrated aggressive behavior toward the dog only if the dog was specifically aggressive toward them. Apparently, it is only when cattle perceive a threat from an approaching canine that they demonstrate aggressive behavior toward the canine. For this reason, simultaneous stocking of a paddock with non-bonded sheep and cattle may not provide protection from canine predation. This study was conducted under typical winter weather on arid rangeland paddocks. It suggests that the predator protection that cattle provide to bonded sheep probably results from the sheep staying close to the cattle and bunching together in among the cattle in the presence of a threatening canine, rather than cattle actively driving away predators. However, the actual response of bonded sheep and cattle in the presence of a threatening coyote has not been observed.

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