# Social behavior of grazing beef cattle: Implications for management

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## Abstract

This paper reviews current knowledge of the social behavior of grazing beef cattle and discusses how that knowledge can be applied to rangeland cattle management. Cattle herds are composed of social subgroups that influence grazing distribution on rangeland. Grazing distribution is, in part, a learned response; therefore, management strategies that alter the social composition and structure of cattle subgroups can affect habitat use. Herding and selective culling are two management strategies that may be used to relieve grazing pressure on environmentally sensitive areas. Cattle form social hierarchies that can present a number of problems when feeding supplements. More dominant animals may consume a greater proportion of supplement than subordinate animals. Sorting cattle into similar age groups with similar physiological demands can decrease overconsumption of supplement by more dominant animals. Adjusting trough space or the number of supplemental feed locations also may reduce variation in supplement consumption. Greater knowledge and application of cattle social behavior should improve management of rangeland cattle.

*Key Words: Selective Grazing, Group Behavior, Social Dominance, Herd Structure, Supplements*

## Introduction

Poor distribution of beef cattle in the western United States has created problems for range cattle producers and natural resource managers. Uneven use of native ranges reduces economic returns per hectare and increases feed costs (Vallentine, 1990). Cattle generally prefer areas with adequate forage in close proximity to water (Senft et al., 1985). Selection of certain habitats such as riparian areas (Howery et al., 1996) may lead to overuse and habitat destruction (Kovalchick and Elmore, 1992).

Previous reviews examined mechanisms influencing ungulate grazing distribution patterns (Senft et al., 1987; Coughenour, 1991; Bailey et al., 1996) and focused on environmental factors and how animals integrate information to select forage at different spatial scales. Other researchers (Smith, 1988) have emphasized how animals' physiological needs, such as thirst, homothermy, and hunger, influence movements within pastures. Although these reviews did refer to social behaviors, they did not incorporate that information into their models of grazing distribution and forage selection. Howery et al. (1998) concluded that cattle distribution was influenced by environmental and social conditions and that herding and selective culling could enhance dispersion and decrease the use of sensitive areas on rangelands.

Our purpose is to review current knowledge of the social behavior of grazing beef cattle and suggest ways this knowledge can be applied to improve rangeland cattle management. The concepts of social dominance and leadership in beef cattle are reviewed relative to their effects on grazing distribution and resource competition. Also addressed is the relationship between resource abundance and the extent to which social dominance is displayed by rangeland beef cattle. We then suggest ways to improve three facets of rangeland cattle management: 1) herding, 2) culling, and 3) supplemental feeding.

## Discussion

### Social Structure of Grazing Beef Cattle

Rangeland cattle are organized in fusion-fission societies (Lazo, 1994) that reflect a social structure with two levels of organization. At the high level, cattle form stable social subgroups within a herd. These "subherds" are often collections of matrilineal groups (Reinhardt and Reinhardt, 1981; Lazo, 1994). Each subherd has a well-defined home range, or area over which the group habitually travels while engaged in its usual activities (Burt, 1943). Home ranges of subherds are usually very consistent from year to year. At the low level of social organization, subherds separate into smaller, unstable subgroups termed "parties" (Lazo, 1994). Parties fluctuate in size and composition according to environmental conditions (Muller et al., 1976). The larger, stable subherds reform when the smaller, unstable parties fuse.

Lazo (1994, 1995) focused on the social structure and habitat use of "mostrenca" cattle, living in the Donana region of Spain since the 13th century with minimal management. About 140 animals live in the Biological Reserve of Donana, where the only recent management has been to remove 30 to 50% of the calves annually. These animals live on 67 km$^2$ of marsh and scrublands. The population is organized into four subherds that are highly stable, closely knit social groups that maintain active spatial and social segregation from other subherds (Lazo, 1994, 1995). Each subherd is composed of an average of 20 adult females, 6 young females, 7 young males, 3 adult males, and 13 calves. Cows rarely joined herds other than the one into which they were born. Other studies also have documented intraspecific social exclusion by sub-

herds of sheep (Winfield and Mullaney, 1973; Winfield et al., 1981; Lawrence and Wood-Gush, 1988) and white-tailed deer (Hawkins and Montgomery, 1969).

Howery et al. (1996) investigated differences in home range and habitat use among individuals in a cattle herd in Idaho. They demonstrated that 78% of the cows showed a high consistency in home ranges. Cows were grouped into four subherds that differed in the amount of time they spent foraging and resting and occupying upland and riparian habitats. Howery et al. (1996) reported that individual cows within subherds did not strongly associate with one another, and the formation of subgroups was likely the result of gregariousness rather than tightly knit, socially based groups. A study with sheep also suggested that subherds were maintained by gregariousness rather than strong family ties (Lawrence and Wood-Gush, 1988).

Reinhardt and Reinhardt (1981) examined interindividual association in a semiwild cattle herd for 5 yr. They found that mother cows preferred their female and male progeny to unrelated calves as grooming and grazing partners for the entire 5 yr. They further concluded that the social structure was based on matriarchal families that are interconnected by means of friendship relationships between non-kin partners.

Some studies with similar animals, such as bison and deer, suggest that there are no strong associations between females, but rather random associations in large groups (Lott and Minta, 1983) or unstable associations in smaller groups (Schaller, 1967). Kilgour (1972) suggested that an important factor influencing the cohesive bonds between herd members could be the management level by humans, which allow those bonds to develop.

### Social Dominance Hierarchies

Social dominance exists when the behavior of an animal is inhibited or altered by the presence or threat of another animal (Beilharz and Zeeb, 1982; Drews, 1993). Cattle are able to recognize other individuals and maintain consistent dominance hierarchies (Broom and Leaver, 1978; Bennett et al., 1985; Bennett and Holmes, 1987). Animals high in the hierarchy have priority to feed, shelter, and water (Broom and Leaver, 1978; Bennett et al., 1985; Bennett and Holmes, 1987). A current year's offspring are near the bottom of a herd's social hierarchy, but when close to their mothers ($\leq$ 3 m) offspring are elevated to their mother's status and receive the privileges attached to their mother's social rank. This has been documented in bison (McHugh, 1958), elk (Altmann, 1956), and wild ponies (Tyler, 1972). Offspring of high-ranked mothers also tend to achieve high social rank as adults (Tyler, 1972; Clutton-Brock et al., 1986). The mechanism for this is unknown. It may be that offspring learn to be aggressive by watching their mothers interact aggressively with other individuals. It may be that offspring inherit aggressive temperaments, or it may be that the other individuals in the herd learned to avoid the offspring when it was near its high-ranked mother and the other animals continued to avoid it after weaning (Tyler, 1972). Wagnon (1966) reported a strong, stable arrangement of social dominance in a mixed-breed cow herd, and Wagnon et al. (1966) reported that Angus cows were more dominant than Shorthorn cows, and both were more dominant than Hereford cows.

Social dominance hierarchies are largely passive. Subordinates avoid conflict and dominant animals make few overt attempts to supplant subordinates. Low-ranked animals monitor their spatial relationships relative to dominant animals. As subordinates get closer to dominants, subordinate animals may reduce their bite rate, stop feeding, or move away, but behavior of dominants is largely unaffected by their proximity to subordinates (Bennett et al. 1985; Bennett and Holmes, 1987). Thus, movements by dominant animals may displace subordinates, and dominant animals enjoy greater freedom in habitat selection. This may restrict the amount or quality of resources available to subordinates (Bennett et al., 1985; Bennett and Holmes, 1987). Dominant animals may preclude subordinate animals from occupying certain sites, and dominant animals have priority access to available resources, including feeding areas, shade, salt licks, supplemental feed, and shelter from storms (Bennett et al., 1985; Bennett and Holmes, 1987). Low-ranked animals are forced to relocate into areas of lower habitat quality or they must wait their turn until the more dominant animals are satisfied and leave the area. If the relative differences in resource utilization are great, dominant individuals and their offspring gain more weight and reproduce more successfully (Wagnon et al., 1966; Broom and Leaver, 1978; Bennett et al., 1985; Bennett and Holmes, 1987).

Dominance hierarchies also exist between subgroups of cattle, and higher-ranked groups limit access to resources by lower-ranked subgroups. Lazo (1994) found that a subordinate subherd reduced its home range area and relocated its home range when higher-ranked subherds came too close. Similarly, dominant subgroups (bands) of feral horses displace subordinate subgroups from watering locations. Horses within the dominant subgroups, in addition to the dominant stallions, display aggression toward horses in the subordinate subgroups, indicating that the hierarchy is, in fact, an intergroup hierarchy and not just a hierarchy of the dominant stallions from each band (Miller and Denniston, 1979).

Social dominance hierarchies play an important role in supplement consumption by rangeland cattle. Wagnon (1966) reported that hand-feeding cows from 2 to 10 yr of age resulted in many 2- and 3-yr-old cows being driven from the feed troughs before they had the opportunity to feed. Subordinate 4- and 5-yr-olds spent less time at the feeders, more time waiting, and gained half as much weight as older, more dominant, cows (Wagnon, 1966).

Friend and Polan (1974) studied the feeding behavior of 21 Holstein cows and found dominant-ranking cows to occupy feeding stalls adjacent to cows of similar social rank. Mean time eating ranged from 2.9 to 4.7 h/d and was quadratically related to social rank. Mid-ranked cows spent the least amount of time eating. The authors concluded that dominance values failed to predict access to feeding stalls. They also doubted the existence of a classical social hierarchy in this herd. Rather, they suggested that cows were driven by physiological demands and that cows operating at

peak production gained access to resources through persistence rather than aggression.

### Resource Abundance and Social Dominance

Differences in resource abundance may account for many apparent contradictions in the literature concerning the presence or absence of social dominance hierarchies. Dominance hierarchies may not be readily apparent when resources are plentiful. However, the absence of agonistic encounters does not refute the existence of dominance hierarchies. When resources are plentiful, animals in a herd commonly feed and rest together, and dominant animals displace subordinates less frequently.

Howery et al. (1998) found that drought weakened the dams' influence on location and habitat use of offspring as water became scarce. Lazo (1994) reported that in winter and spring, cattle herds maintained large home ranges and individuals formed small parties. In the summer and autumn, individuals formed large parties and smaller home ranges concentrated near water and feed. He stated that even with limited resources available, spatial segregation among herds promoted social isolation more than exploitation of a territory or home range.

The influence of social dominance on supplement consumption depends on the relative availability of supplemental feed and trough space. The proportion of sheep not consuming supplement fed once daily in troughs increased from 0 to 31% as linear trough space was decreased from 24 to 4 cm per animal (Arnold and Maller, 1974). However, excess trough space could increase variation in hand-fed supplement consumption. Wagnon (1966) observed that less fighting and agonistic behavior occurred during supplementation when linear trough space was 91 cm/cow than when 180 cm/cow was allowed. The smaller bunk allowance did not allow cows to fight without backing away from the trough, and therefore fewer animals were pushed away from the supplement. When excessive trough space was allowed, dominant cows chased others away from one side of the trough and spent more time fighting than eating.

Larger quantities of supplement provided per animal can reduce the variation in individual animal consumption and the proportion of non-feeders. Foot et al. (1973) found that the coefficient of variation (CV) of supplement intake was reduced when supplement allowance was increased. Ducker et al. (1981) reported that the proportion of grazing ewes not consuming block supplement was highest when supplement consumption by the total flock was low, and the proportion of non-feeders decreased as supplement consumption by the total flock increased. Kendall et al. (1980) combined the effects of trough space and supplement allowance by offering grazing ewes different amounts of supplements with varying trough space. When supplement allowance was high, trough space had little effect on CV of supplement intake. When supplement allowance was low, trough space had a large effect on CV of supplement intake.

Bowman et al. (1999) examined supplement use by 2- and 3-yr-old cows on Montana rangelands. They reported that 2-yr-old cows consumed less supplement than 3-yr-old cows when supplement was offered for ad libitum consumption. Restriction of the supplement with a different feeder design resulted in similar consumption levels between the two age groups. This supports Wagnon's (1966) finding that increasing competition may reduce overconsumption by some animals.

### Herd Leaders

The concepts of leadership and dominance are often confused, but they describe two distinct behaviors. Animal groups are led by individuals that initiate an activity (grazing, traveling, or resting) that is different from the activity of the remainder of the group. If the remainder of the group does not follow, the "leader" returns to the activity of the group (Sato, 1982). Leaders are individual animals that consistently initiate movements that cause others to follow.

Leaders seem to be animals that move purposely in a direction, attracting the attention of others (Tyler, 1972; Greenwood and Rittenhouse, 1997). Purposeful movement may come from having more knowledge of where resources are located (Greenwood and Rittenhouse, 1997). This may explain why, in spring, adult ewes of bighorn sheep migrate to alpine range before yearling ewes (Festa-Bianchet, 1988). However, Tyler (1972) found that any member in a group of wild ponies could be a leader, even an immature animal.

Most studies have found little correlation between leadership and dominance. Popularity or sociability may determine leadership. Syme (1981) found that leaders in a group of sheep were the more sociable animals. Reinhardt and Reinhardt (1981) reported that the leader in a group of cattle was the most popular cow; that is, the cow that was the preferred associate of many herd members. She was an average cow in terms of age, reproduction, weight, and social rank, but her movements were attentively observed by the other group members. Sato (1982) observed a tendency for high-ranked cows to be leaders and low-ranked cows to be followers. This tendency seemed to be related to the fact that higher-ranked animals moved around more actively, and actively moving animals may have attracted attention and caused others to follow.

### Management Suggestions

*Herding.* Herding is a proven tool for controlling livestock distribution, but herding must consider livestock social behavior to be effective. Cattle subgroups, for example, should be dispersed as a unit; otherwise, individuals separated from their subgroup will return to their former location (Skovlin, 1957, 1965; Roath and Krueger, 1982). A herder should purposely relocate subgroups to alternative sites rather than merely harassing animals to disperse them from a preferred site. Mere harassment often results in cattle returning within minutes or hours to their former site. Rather than trying to disperse large numbers of cattle at once, it is better to gather only one subgroup or a few subgroups at a time and then guide them to a new site. Upon arrival at the new site,

the animals should be shown the location of water, salt, and palatable forage. The herder should then remain with the animals in their new location until the group has settled. This often requires 30 min to 2 h. The approach is similar to trailing cow/calf pairs to a new pasture and then waiting there to make certain that every cow has claimed its calf. The time spent ensuring that subgroups establish their new "home base" saves much time that would otherwise be spent repeatedly harassing animals away from their former locations. Budd (1999) suggested that when moving cattle to a new grazing site, it is best to move them before they have watered, and when trying to relocate cattle to new loafing areas, it is best to move them soon after they have watered. These strategies make cows more inclined to graze or rest when they reach their new location, rather than immediately returning to their former location.

Individual animals sometimes do not respond to herding, and these individuals should be culled from a herd (Skovlin, 1957, 1965). Eliminating uncooperative individuals will help develop a group of animals that readily responds to herding. Diligent herding can train cattle to use certain areas of a landscape even though they may prefer to use others.

*Culling.* Some authors (Roath and Krueger, 1982; Howery et al., 1996, 1998) have extended Skovlin's concept of selective culling to suggest that selective culling might be used to develop a herd of upland-dwelling cattle. Their recommendations are based on the premise that certain individuals or subgroups within a herd prefer, or are accustomed to, riparian habitats, whereas others prefer or are accustomed to upland habitats. Selective culling on this basis should be considered cautiously because its effectiveness is unknown. Some individual herd members spend disproportionately more time within riparian areas (Roath and Krueger, 1982; Howery et al., 1996, 1998), but it is possible that in their absence and without diligent herding the desirable habitat in the vacated riparian area would simply be reoccupied by other individuals within the herd. This is what occurred in Scotland when Hunter (1960) selectively culled sheep that had occupied the preferred grazing areas within a pasture. Hunter speculated that the sheep removed from the preferred grazing area had been a high-ranked group, and after their removal their home range was occupied by a lower-ranked group. In northern England, Rawes and Welch (1969) found that stocking rate reductions of sheep did not alleviate grazing pressure on the better sites and only reduced use of the less desirable areas. Many similar examples exist in the western United States, where reducing numbers of livestock has done very little to redistribute grazing pressure away from riparian zones.

Selective culling has longer-lasting results when all females in a subgroup are removed. This ensures that reoccupation can only occur by dispersing females rather than reproduction by females that escaped culling. Selective culling will probably not be effective if outside animals are introduced into the herd. Translocated animals often do not assimilate into the subgroups of the existing population and instead establish new home ranges. Translocated animals could occupy the habitat vacated by selective culling. Simi-

larly, selective culling has little chance of success if ranchers do not select replacement females from animals reared in the same pasture from which animals were selectively culled. Replacements reared elsewhere that cannot return to their natal home range will probably establish their home ranges in the vacated habitat. Finally, livestock managers using selective culling should also make certain that replacement females selected from the herd were not raised by cows whose home ranges included the targeted removal area. Otherwise, the replacements will likely perpetuate the foraging pattern of their culled mothers.

*Supplemental Feeding.* Many cow-calf producers have routinely used knowledge of herd social structures and hierarchies to improve the uniform delivery of supplements. Cattle herds should be separated into similar age and body condition classes when possible. This will reduce overconsumption by older, heavier, more-dominant animals. Research results from Bowman et al. (1999) suggest that even 2- and 3-yr-olds should be separated because 2-yr-old cows did not receive adequate supplement when pastured with 3-yr-old cows. Overconsumption of self-fed supplements by a few older, more-dominant animals may be reduced by increasing competition. This can be accomplished by reducing trough space or supplement allowance. Underconsumption by younger, subordinate cows can be decreased by providing more supplement troughs located in primary grazing areas, reducing the chances that a dominant cow will prevent younger cows from coming to the trough.

## Implications

Researchers have concentrated on the physiological factors that influence distribution patterns of cattle on rangelands but have minimized the social factors. Social dominance hierarchies influence grazing distribution and supplement consumption by range cattle. Early experiences in life affect cattle distribution, and herding and selective culling are management tools that could be used to change cattle distribution. Scientific research into the social factors influencing beef cattle distribution will require an intimate knowledge of the pastures and of the animals. Failure to address these relationships will prevent grazing managers from achieving many of their resource objectives.

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**Notes**

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