Woody cover and proximity to water increase American black bear depredation on cattle in Coahuila, Mexico

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American black bear (Ursus americanus; hereafter, bear) depredation on cattle is not common, but at localized levels, it can be problematic (Dorrance 1982, Horstman and Gunson 1982, Andelt 1996). Bears killed 2,800 head of cattle in the United States during the year 2010, which resulted in a loss of US$1,415,000 (NASS 2010). This represented only 1.3% of all cattle depredations in the United States that year, but depredation on cattle can have significant impacts on a small-scale producer. Dorrance (1982) noted that black bears accounted for 31% of confirmed cattle losses to depredation in Alberta. It is possible that bear depredation is not adequately reported in the literature because salient beliefs that bears are herbivorous result in people attributing the kill to another predator (e.g., mountain lion [Puma concolor], wolf [Canis lupus], or coyote [C. latrans]). For example, Andean bears (Tremarctos ornatus) were often considered strict herbivores until research verified that they caused some cattle depredation in areas where bear habitat abutted pasture land (Goldstein et al. 2006).

Although black bears are not considered major predators, they are considered efficient predators of ungulates in multiple systems of North America (Kunkel and Mech 1994, Linnell et al. 1995, Bastille-Rousseau et al. 2011). Some research has shown that black and brown bears (U. arctos) depredate wild ungulates, both adult and neonate (Schlegel 1976, Franzmann and Schwartz 1986, Gunther and Renkin 1990, Larsen et al. 1989, Vreeland et al. 2004). Black and brown bears also depredate domestic
swine, sheep, and cattle (Mysterud 1980, Dorrance 1982, Horstman and Gunson 1982, Dahle et al. 1998, Knarrum et al. 2006). Black bear depredation on livestock is more typical in western North America; however, there are reports of bear depredation on livestock in eastern locales (e.g., in Maine; Spencer 1961). In some cases, black bear depredation on livestock is a nontrivial and costly issue. For example, during 1974–1979, Alberta’s Livestock Predator Indemnity Program paid out 541 claims for black bear depredations on livestock. Of the livestock claims, 81% were for cattle; and of the cattle claims, 71% were for calves. In other places, black bear predation on cattle is a rare occurrence.

Bear depredation on livestock is facilitated by bear density, environmental conditions, or livestock management (Bjorge 1983, Kaczensky 1999, Anderson et al. 2002) that create potential “hot spots” (Wilson et al. 2005) and “information centers,” where bears may gain information from others at a feeding site (Galef and Giraldeau 2001). It is speculated that visual observation of successful kills and opportunistic feeding on remnant carcasses may reinforce depredation behavior in individual bears, and cubs may learn from mothers (Stirling and Derocher 1990, Linnell et al. 1999). Landscape features, such as vegetation, fences, or variations in topography, can enhance success for predators (Carbyn 1997, Wilson et al. 2005, Goldstein et al. 2006, Kluever et al. 2008, Poessel et al. 2011). Foraging in dense cover can limit the scanning ability of some ungulate species (Scheel 1993, Kuijper et al. 2014). Domestic sheep that browsed in dense forest cover had increased depredation risk from grizzly bears (U. arctos) foraging on berries in the same patches (Jorgensen 1983). Cattle depredation risk from bears and wolves in western North America is higher in dense forest cover than in more open habitats (Dorrance 1982). Cattle eyesight is better adapted to scanning at greater distances than for objects in close proximity. Cattle also have limited peripheral vision, which may limit their ability to spot predators, particularly in dense vegetation (Grandin 1989). Some species exhibit anti-predatory defense behaviors such as mobbing and charging predators (Lipetz and Bekoff 1980, Wallace 1983, Caro et al. 2004) or using their horns to ward off predators (Stankovich and Caro 2009). However, if visual detection is limited by landscape features, livestock depredation risk may be increased despite defensive behavioral adaptations.

Currently, we know little about the influence of water on bear–cattle interactions in arid areas; other predator–prey relationships at waterholes are also somewhat unclear (Hopcraft et al. 2005, de Boer et al. 2010, Simpson et al. 2011). Black bear depredation behavior likely differs from that of strict carnivores because of bears’ dependency upon plant-based foods, which also makes them more vulnerable to the immediate impacts of drought. They are able to switch their diets to animal protein and anthropogenic food sources during periods of food scarcity (Zager and Beecham 2006, Johnson et al. 2015).

In arid areas, water likely has a strong influence on the severity and frequency of bear depredation conflicts. In northern Mexico, water is limited and often available only at artificial sources maintained for livestock, or remote springs; however, during rainy periods, water sources are more widespread and include ephemeral streams and pools. Drought periods often coincide with calving periods; therefore, wildlife are often drawn into cattle watering areas. This phenomenon concentrates predators and prey, thus increasing the probability of encounter (Valez et al. 2009). In Mexico, where both bear and cattle densities are high and drought severity is increasing, bears and cattle concentrating around water sources can augment the potential for conflict.

Although the black bear is listed as endangered in México (SEMARNAP 1999), the population in the Serranias del Burro, Coahuila, Mexico, is robust. Bears in this remote, 3,000-km² mountain range are abundant (0.33–0.56 bears/km²), with high reproductive rates and low human-induced mortality (Doan-Crider and Hellgren 1995, Doan-Crider 2003). Despite high bear densities, depredation on cattle was isolated and sporadic, with only a few reports from 1991 to 1998. However, we started to receive an unusually large number of reports during a severe drought in 1999–2000. Similar increases in depredation were noted throughout the region (E. Spence Sellers, Rancho La Escondida, unpublished data; D. Garza Laguera, Rancho El Rincon, personal communication). Cowboys noted differences in cattle depredation incidences in varying levels of woody cover and around water; thus, local knowledge was essential for the design of this project.

Our research objective was to determine how landscape features influence cattle depredation by black bears. We hypothesized that (1) black bears would utilize screening cover to predate upon calves and that areas with dense cover would have greater depredation risk, and (2) because of concentrated bears and cattle around water sources, depredation risk would increase with proximity to water.

**Study area**

Our study area was located on the Las Pilas, El Sombrero, and Las Antonias ranches in the Serranías del
Burro, Coahuila, Mexico, which lie approximately 60 km southeast of Big Bend National Park, Texas, USA (Fig. 1). This mountain range borders the Chihuahuan Desert Shrub in the Central Plateau Region and the Tamaulipan Thorn Shrub in the Coastal Plain Region of Mexico (Muller 1947). Approximately 3,000 km² of black bear habitat is included in a privately owned cooperative conservation unit, which has jointly protected the area from poaching since the early 1980s. Terrain consists of alluvial meadows and rocky foothills that are bounded by steep limestone escarpments. Elevations range from approximately 1,000 to 2,300 m. Vegetation consists of grasslands, chaparral scrub, mixed conifer forests, and mesic canyons (Bartoskewitz 2001). Average annual rainfall during 1991–1997 was approximately 580 mm/year; however, during 1999–2001, annual rainfall was approximately 195 mm (D. Garza Laguera, unpublished data).

Cattle and pasture conditions on the study area were managed intensively, using the Holistic Management rotation system (Savory 1983). Most pastures were pie-shaped with water tanks in the center, and were divided by 2-strand wire fence with a single upper electrified wire; several pastures were not pie-shaped, but had ≥1 water source and were rotated after high-density–short-term use. Vegetation within pastures consisted of native grasslands interspersed with oak–shrub woodland (e.g., Quercus gravesii, Arbutus xalapensis, Berberis trifoliata), but included other species that provide cover and food for bears, such as prickly pear (Opuntia spp.) and...
yucca (*Yucca* spp.). Cattle grazed in both lower grassland valley bottoms and oak–shrub communities in upper elevations of the foothills. Cattle were counted daily by cowboys, and new calves were ear-tagged within one day of birth.

Cattle herds in this area are adapted to protect calves from black bears, both physically and behaviorally. Defensive behavior toward bears is reinforced through culling of cows that lose their calves to depredation or other factors influenced by poor maternal instincts (G. Osuna, Rancho Las Pilas, personal communication). Behavioral traits such as mother-cows staying close to calves while foraging, or leaving calves with “babysitter” cows, are reinforced. In addition, horns are not removed from mother cows so that they may use them when confronting predators. As a result of high-density, fast-rotation pasture management, cattle are accustomed to being kept together in large groups, which increases their ability to detect predators and protect against depredation (Caro et al. 2004). Mother cows, particularly those with horns, can be highly defensive against predators once they become alarmed. Ranchers observed that cattle often grouped up and “mobbed” black bears that threatened calves (G. Osuna, personal communication).

**Methods**

We monitored 3 separate cattle herds for depredation events. Each herd contained 70–190 mother cows in pastures on the Las Antonias, El Sombrero, and Las Pilas ranches. Distance between each herd was 3–10 km. We defined woody vegetation as shrubs, trees, and succulents >1 m in height. We defined grasslands as open areas covered in grasses, forbs, and succulents <1 m in height. Pastures in the Las Antonias were open grassland valley bottoms surrounded by oak–shrub and oak woodland communities that extended up into the foothills. The El Sombrero pasture was similar in vegetation structure, but the cattle herd was contained in one grassland pasture with a watering trough in the center, and was not divided by pie-shaped cells. Grassland communities at Buena Vista were narrower than at the previous 2 pastures and woody vegetation was somewhat patchier.

We, along with the cowboys and ranch managers, kept daily records on herd size, calf births, and losses. Cowboys assisted us by monitoring depredation activity, recording bear sightings, and helping to locate calf carcasses. However, cowboys tended the herds only during daylight hours (0600–1800 hr). We used a normal approximation for a binomial distribution (Fleiss 1981) to test whether the proportion of time cattle spent in grassland versus woody vegetation differed from the proportion of kills that took place in each of these community types in the Las Antonias and El Sombrero herds. We extrapolated information from these 2 herds to the Buena Vista herd because of logistical constraints. We counted cows and calves in study pastures during 11 visits over a 3-week sampling session (12 May–5 Jun 2000); observation intervals were 2–3 hours, and occurred during randomly selected time slots within a 24-hour period with the exclusion of afternoon feeding time (1500–1800 hr). We chose these dates because they encompassed the calving period, which was when depredation was most likely to occur. We used spotlights to locate and count cattle at night. We assumed that any cattle not seen in grasslands were in the brushy vegetation. There was a distinct perimeter of woody vegetation surrounding each pasture, so we considered cattle to be “in the open” if they were standing on the open side of the perimeter.

Once we detected a calf death, we attempted to locate the site of the kill within 24 hours. In most cases, the site of the attack was evident based on disturbances to the ground and surrounding vegetation. We frequently found fresh blood on the soil or on broken branches. Drag marks were often evident between kill site and the location of the carcass, which varied from 0 to 1 km from the kill site. If no kill site was located, then we censored the incident from analysis.

We determined the cause of death using techniques described in Wade and Bowns (1984) and as per instruction by B. O’Gara (U.S. Fish & Wildlife Service, personal communication). We documented any hemorrhage, bone breakage, and injury patterns, as well as tracks and drag marks. We did not solely use the presence or absence of bear scat or tracks as definitive evidence because bears commonly scavenge carrion. In addition, we did not use carcass caching patterns as the sole source of evidence because we observed bears burying carcasses in a manner similar to mountain lions on numerous occasions. We verified black bear kills using a combination of all the above factors. If we could not verify the kill was caused by a black bear, we did not include the observation in the analysis.

After locating a kill site, we assessed woody screening cover to determine whether the site was woody or grassland. We conducted 2 perpendicular, 10-m line transects centered on the kill site in the 4 cardinal directions. In addition to the kill site, we conducted paired random vegetation measurements at another grassland and woody community site, but only if those sites were available within 1 km of the kill site. These additional sites were located by walking a random distance and azimuth from
the kill site until sites in both open grassland and closed woody vegetation were obtained. To ensure that the sites we chose as “grassland” or “brush” sites were unambiguously classified, we compared the confidence intervals of 3 variables from the kill sites to make this assessment (sighting distance, percent vegetation cover >1 m and vegetation cover <1 m). If the random sites had characteristics that fell within the 98% confidence intervals of the grassland or brush, we characterized them as such; if they were somewhere in between those values, we picked another random azimuth and distance until we found a suitable comparison site. We used a 2-m-tall cover board to assess percent vegetation cover >1 m, and vegetation cover <1 m (BLM 1996). We estimated mean sighting distance (i.e., the mean distance at which <5% of a bear-sized silhouette was visible from the center of the plot while an observer walked away in each of the 4 cardinal directions; Mollohan 1987).

To assess the probability of cattle depredation, we generated logistic regression models in Program R 3.1.1 (https://www.r-project.org/) to assess factors that influenced cattle depredation by black bears at 42 sites (16 kill sites, 15 random locations in woody cover, and 11 random sites in grassland). We conducted a Pearson’s correlation analysis to assess collinearity among predictor variables and removed any variable in which correlation ($r$) was >0.50. Sighting distance was correlated with both percent vegetation cover measurements, so we eliminated the vegetation cover measurements. We built models with linear combinations of the following variables: habitat type (grassland or woody), distance to the nearest water source (m), and mean sighting distance (m). We used the natural log to transform all distance variables to satisfy normality assumptions in the regression. We tested the following full model for all plausible 2-way interactions: (kill probability ~ brush or grassland + distance to water tank + distance to nearest cover). Finding no significant 2-way interactions, we generated a candidate set of models with all possible subsets of the full model (Table 1). We calculated a Nagelkerke’s $R^2$ (Nagelkerke 1991) for each model and selected the most parsimonious from the candidate model set using weights of second-order Akaike’s Information Criterion adjusted for small sample size (AIC$_c$) and AIC$_c$ differences relative to the smallest AIC$_c$ value ($\Delta$AIC$_c$; Burnham and Anderson 2002). We used a cutoff value of $\Delta$AIC$_c$ of 7. If there were competing models within the cutoff, we selected the most parsimonious model within the set if uninformative parameters (sensu Arnold 2010) were included in the top models.

### Results

We received >60 reports of calf kills for the 3 herds. We verified black bears as the predator for 28 of these reports and determined exact location of the attack for 16 of these kills. All 16 of these kills occurred at night (from 2100–0400 hr) after the ranch workers returned to their homes. We did not find sign for any species other than bear at kill sites. We were unable to determine the location of any additional kill sites because of the ground disturbance (i.e., cattle and deer [Odocoileus spp.] prints obfuscated the sign) or there was not sufficient sign to locate the exact site of the kill. Fifteen of 16 kills were on calves <1 month old and 1 kill was of a cow giving birth, which resulted in the deaths of both calf and cow.

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**Table 1. Candidate set of models developed to understand how landscape features affect American black bear (Ursus americanus) depredation on cattle in the Serranias del Burro mountains, Coahuila, Mexico, during 1999–2000.**

<table>
<thead>
<tr>
<th>Candidate model set</th>
<th>$K^b$</th>
<th>AIC$_c^c$</th>
<th>$\Delta$AIC$_c^d$</th>
<th>AIC$_c$ wt</th>
<th>Cumulative wt</th>
<th>Log likelihood</th>
<th>Nagelkerke’s $R^2$,$e$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predation probability = habitat type + proximity to water</td>
<td>3</td>
<td>47.63</td>
<td>0.00</td>
<td>0.76</td>
<td>0.76</td>
<td>−20.45</td>
<td>0.46</td>
</tr>
<tr>
<td>Predation probability = habitat type + proximity to water +</td>
<td>4</td>
<td>50.03</td>
<td>2.39</td>
<td>0.23</td>
<td>0.99</td>
<td>−20.39</td>
<td>0.45</td>
</tr>
<tr>
<td>proximity to screening cover</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*aDrought conditions.
*bNo. of parameters.
*cAkaike’s Information Criterion corrected for small sample size.
*dChange in Akaike’s Information Criterion corrected for small sample size between top model and the model in question.
*eNagelkerke’s $R^2$ coefficient of determination.
*fWoody vs. Grassland habitat.

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Fourteen of 16 kill sites occurred in woody vegetation, while the remaining 2 were in grassland.

Horizontal cover and sighting characteristics of grassland and woody vegetation sites had non-overlapping confidence intervals (Table 2) that enabled unambiguous classification of kill sites. Every kill site had ≥1 of the 3 variables that was contained in confidence intervals of either grassland or woody vegetation random sites.

Cattle used woody and grassland habitat in similar proportions during 22 observation periods on 523 cattle (324 mother cows and 199 calves). Calves spent an average of 57 ± 13% (90% CI), and mother cows spent an average of 47 ± 12% (90% CI), of the time in grassland. Calves were killed in woody sites more often than in grassland sites (14 vs. 2, respectively), despite similar proportions of their time in grassland and woody sites. We found no support for any 2-way interaction among explanatory variables. Our best supported model had 3 times more support than the next best model (AICc weight = 0.76 vs. 0.23, respectively); it was logit(depredation risk) = 1.52 + 2.06 × (1 if grassland; otherwise 0) − 1.54 × ln(distance to water tank; Table 1). These 2 variables (woody vs. grassland and proximity to water sources) explained 46% of the variation in the data set (Nagelkerke’s $R^2 = 0.46$). Probability of calf mortality declined quickly as distance from water tank increased and was 2–3 times higher in woody areas than grasslands (Fig. 2).

Most reports of cattle depredation in the Serranias del Burro were received during the calving period between 11 April and 5 June. Several instances of depredation-related cattle and bear behavior were worth noting. We documented a group of approximately 15 cows that successfully chased a black bear away from a calf that had been dragged into the brush, which was like other reports from ranchers. For 4 kills—2 that occurred in grassland areas and 2 that occurred in woody areas—bears dragged calves under fences prior to consuming them. In one case, a mother cow successfully broke through a 2-strand electric fence line to defend her calf, but it had already been killed. She remained with the carcass and defended it against the bear for a full day until a cowboy roped the cow and removed the carcass. All other calves killed in grassland areas were dragged into thick brush or up hillsides where cattle access appeared limited.

### Discussion

Landscape features, such as water sources and vegetation structure, influenced depredation risk by black bears upon calves during severe drought. Calf kill frequency was higher in woody vegetation, even though cattle spent similar proportions of their time in grassland and woody vegetation. Fences also appeared to serve as escape cover for bears, possibly hindering mother cows from mobbing and retrieving calves from fleeing bears.

Several other factors coincided to make calves susceptible to bear depredation. The annual shortage of bear foods during the spring and early summer (Doan-Crider 2003) was likely amplified by the drought, forcing bears to rely on food sources other than their typical spring diet of herbaceous vegetation, succulents, and overwinter acorns. Aside from the increase in livestock depredation reports, human–bear conflicts also increased—including one predatory attack involving a ranch worker who was dragged from his campsite by a bear that had been preying on calves—as well as numerous bear intrusions into ranch homes.

Optimal foraging theory suggests that wildlife maximize caloric intake while minimizing energetic costs to acquire that food (Sinervo 1997). Theory also suggests that bears also try to minimize risk of death and therefore do not kill calves or steal human foods during times of plentiful food, but only in the absence of other foods that are less risky to acquire. Black bears are opportunistic omnivores that readily adapt to alternative food sources, and can readily switch to killing young ungulates and becoming proficient predators (Kunkel and Mech 1994, Vreeland et al. 2004). This theory is supported when bears are depredating cattle because bears select younger calves over yearling and adults (Dorrance

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**Table 2. Percent cover of woody vegetation <1 m and ≥1 m tall, and sighting distance (m) of sites where cattle calves were killed by American black bears (Ursus americanus) and of random grassland and woody sites in Coahuila, Mexico, May–June 2000**

<table>
<thead>
<tr>
<th>Site type</th>
<th>Variable</th>
<th>Mean</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kill site</td>
<td>1 m brush</td>
<td>16</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>&gt;1 m brush</td>
<td>20</td>
<td>9</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Sighting distance (m)</td>
<td>98</td>
<td>36</td>
<td>170</td>
</tr>
<tr>
<td>Random grassland site</td>
<td>1 m brush</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>&gt;1 m brush</td>
<td>234</td>
<td>141</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td>Sighting distance (m)</td>
<td>1 m brush</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>1 m brush</td>
<td>24</td>
<td>15</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Sighting distance</td>
<td>39</td>
<td>24</td>
<td>54</td>
</tr>
</tbody>
</table>

*Drought conditions.*

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Fig. 2. Probability of calf mortality from American black bear (Ursus americanus) depredation declined with distance from water tanks in woody and grassland habitats during drought in Serranias del Burro, Coahuila, Mexico, 1999–2000.

1982, Horstman and Gunson 1982, Bjorge 1983). On numerous occasions, we observed bears using screening cover to “skulk” around the periphery of pastures containing cattle herds. It was not uncommon to see 3–4 bears frequenting individual herds during a single observational period, and in one instance, we observed 9 bears within a 1-hour period at the Las Antonias herd.

Bears must obtain water directly (Robbins 1992). Most ephemeral water sources dried up during the drought, and to conserve water, well-meaning ranchers closed troughs in other pastures that were not being used by cattle. Bears were likely funneled into the center of pastures where calving was taking place, which presented them with opportunities to prey upon vulnerable calves. Conditions that bring livestock and bears into close association can increase depredation problems (Jorgensen 1983). Low water availability, combined with low forage production, increased the probability of encounter between bears and cattle, augmenting the potential for conflict (Valeix et al. 2009).

The lack of cowboy supervision after sunset allowed for bears to freely roam through herds without consequence, which may be the reason that more depredation appeared to take place at night. On several occasions during daylight hours, cowboys with dogs were able to detect and scare bears away from the herds. Coincidentally, no depredation incidents were noted after 3 July, which was also the date of the first rainfall of the

summer. At that time, however, the youngest calves were reaching 1 month of age. Their increased mobility may have reduced their susceptibility to depredation, and the availability of new water sources may have caused a shift in bear movements. Brown bears in Sweden exhibit a similar pattern in which older moose (Alces alces) calves are much harder to kill; only 8% of moose calf predation occurs when calves are >1 month old (Swenson et al. 2007).

Bear depredation on ungulates occurs worldwide. At least 4 of the world’s 8 bear species have been documented to depredate domestic or wild ungulates, and human–bear conflicts often arise when these bears depredate livestock (Can et al. 2014). This is because bears can be efficient predators of ungulates when conditions are suitable and it is easier to kill livestock than forage on other resources (i.e., during ungulate birthing season when neonates are most vulnerable; Vreeland et al. 2004, Swenson et al. 2007). Brown bears consume wild ungulates (Franzmann et al. 1980, Gunther and Renkin 1990, Swenson et al. 2007) and livestock throughout their range (Mysterud 1980, Linnell et al. 1999). American black bears depredate and consume both wild and domestic ungulate neonates (Dorrance 1982, Horstman and Gunson 1982, Kunkel and Mech 1994, Vreeland et al. 2004). Andean bears will depredate cattle when conditions are suitable (i.e., when ranches and farms are juxtaposed next to the forest; Goldstein et al. 2006). Similar to the black bears in our study, Asiatic black bear (Ursus thibetanus) can depredate livestock when human vigilance is low (i.e., at night; Wang and MacDonald 2006, Yadav et al. 2009, Charoo et al. 2011). One common theme in livestock depredations by bears is that they capitalize on resources when they are easy to acquire—good herd management, remaining vigilant around the herds, and keeping livestock out of areas that make for easy depredation by predators (i.e., good screening cover) can reduce human–bear and livestock–bear conflicts. An old quip from Ray Hunt, a legendary horse trainer, provides helpful guidance: “make the right things easy and the wrong things difficult”—keeping livestock out of precarious situations reduces the probability of human–bear conflict.

Management recommendations

Bears may kill calves more frequently in areas with woody vegetation than grasslands, so we recommend that cattle be maintained in pastures with little woody cover for ≥1 month after calving begins. Management tools to create or maintain open grasslands, such as restoration grazing or prescribed burning, may be necessary where bears occur around calving grounds. Isolated water sources may serve as attractants for bears during drought; therefore, additional watering areas away from herds should be maintained to disperse wildlife use. Defensive vigilance behavior of cattle should be encouraged by allowing cows to stay in groups, giving them better visibility, and not de-horning mother cows. Drought may augment the potential for conflict, so cattle management strategies during periods of low rainfall may need to be altered to minimize losses. Single- and double-strand fencing may allow calves to become separated from mothers and be more susceptible to depredation, and provide escape cover for bears. Thus, calving pastures should have net-wire fence. If labor costs permit, it might also be beneficial to monitor herds 24 hours/day until calves are 1 month old, and to discourage bear concentrations where learned predatory behavior may be facilitated. To minimize the cost and disruption of these practices, calving intervals should be concentrated and shortened as much as possible in areas of potential conflict with bears so herds can be closely monitored, or calving periods shifted to seasons when alternative foods are available to bears, possibly making calves less vulnerable to depredation.

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