Efficacy of an animal-activated frightening device on urban elk and mule deer

Kurt C. VerCauteren, John A. Shivik, and Michael J. Lavelle

Abstract Cervids readily adapt to suitable human-altered landscapes and can cause several types of damage, including economic loss associated with landscape and agricultural plantings, human health and safety concerns, and adverse impacts on natural habitats. The need for effective, practical, and nonlethal tools to manage damage caused by elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and white-tailed deer (*Odocoileus virginianus*) has been heightened by the growing prevalence of locally overabundant populations and public demand for nonlethal wildlife management methods. Various frightening devices are available commercially, but most have not been subjectively evaluated. We used consumption measurements to evaluate the efficacy of a specific motion-activated light- and sound-emitting frightening device for urban mule deer and elk. The devices proved ineffective; deer and elk ignored them. As the demand for frightening devices to reduce deer and elk damage increases, it is important that research be conducted to evaluate the efficacy of new devices so that users know what level of efficacy to expect.

Key words *Cervus elaphus*, Critter Gitter™, elk, frightening device, mule deer, *Odocoileus hemionus*, wildlife damage management

The need for site- and time-specific methods of deterring elk (*Cervus elaphus*) and deer (*Odocoileus* spp.) damage in both urban and rural environments continues to intensify. In urban areas elk and deer often habituate to humans and consume abundant and high-quality foods such as vegetable gardens, ornamental plants, and fertilized lawns (Swihart et al. 1995, Conover 1997*a*, Kie and Czech 2000). These food resources and absence of predators (including hunters) allow elk and deer to thrive in these areas. In rural regions the majority of cervid diets may consist of agricultural crops (Austin and Urness 1993, Austin et al. 1998, Wisdom and Cook 2000). Most agricultural producers reported crop damage from elk and deer and claim these animals caused more damage than other wildlife species (Conover and Decker 1991, Conover 1994, Wywialowski 1994). Conover (1997*b*) conservatively estimated annual agriculture damage from deer at $100 million (U.S.). Elk and mule deer (*O. hemionus*) were a major tourist attraction in Estes Park, Colorado, USA, but also caused damage to gardens, ornamentals, agricultural crops, and golf courses (Singer et al. 2002). Elk also are involved in about 1 vehicle collision per day during the breeding season (R. Spowart, Colorado Division of Wildlife, personal communication).

Successful damage-reduction strategies should be easy to implement prior to and while damage is

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occurring and should be part of an overall integrated cervid-management program. Several types of fences effectively reduce or prevent cervid damage (Craven and Hygnstrom 1994, DeCalesta and Witmer 1994, Lavelle to VerCauteren et al. unpublished data) but may not be cost-effective relative to the value of the resource being protected, even if pro-rated over the life of the fence (Lavelle to VerCauteren et al.unpublished data). Cervid populations can be managed effectively through hunting (VerCauteren and Hygnstrom 1998, Woolf and Roseberry 1998, Brown et al. 2000, VerCauteren and Hygnstrom 2002), though it may not be safe, practical, or socially acceptable in urban and suburban settings.

Most research evaluating frightening devices for cervids has focused on white-tailed deer (*O. virginianus*) (Belant et al. 1996, Belant et al. 1998, Beringer et al. 2003); little has been published regarding the efficacy of frightening devices for elk and mule deer (Krausman et al. 1996). Cervids typically habituate quickly to "frightening" sounds, sights, or smells (Bomford and O'Brien 1990, Koehler et al. 1990, Gilsdorf et al. 2003). Shell crackers, gunfire, propane cannons, scarecrows, and similar frightening devices generally are ineffective, even for short time periods (Koehler et al. 1990, Belant et al. 1996, Gilsdorf et al. 2004*a*). Conversely, Beringer et al. (2003) evaluated a motion-activated frightening device with acoustic and visual stimuli that repelled white-tailed deer from soybean plots for 6 weeks, though efficacy decreased late in the study. Two other motion-activated frightening devices proved ineffective for white-tailed deer (Belant et al. 1998, Gilsdorf et al. 2004*b*).

Damage by cervids and other wildlife on suburban landscapes has spawned an interest in developing products designed to repel animals. Our goal was to evaluate one of these products, a motion-activated electronic frightening device, on mule deer and elk.

Methods

We evaluated a frightening device marketed to homeowners to protect gardens or landscaping. The Critter Gitter™ (Amtek, San Diego, Calif.) was a compact, battery-operated device activated when passive-infrared sensors detected movement and body heat within a 90° arc of the device and out to a maximum of 50 m (manufacturer statement). The device activated for 5 sec each time the sensor detected movement. The alarm approached 120 decibels in volume (manufacturer statement) and consisted of a repeated series of low- to high-pitched beeps that varied in pattern each time the device was activated. A pair of red, light-emitting diodes designed to simulate predator eyes (manufacturer statement) flashed on the front of the device while the alarm sounded.

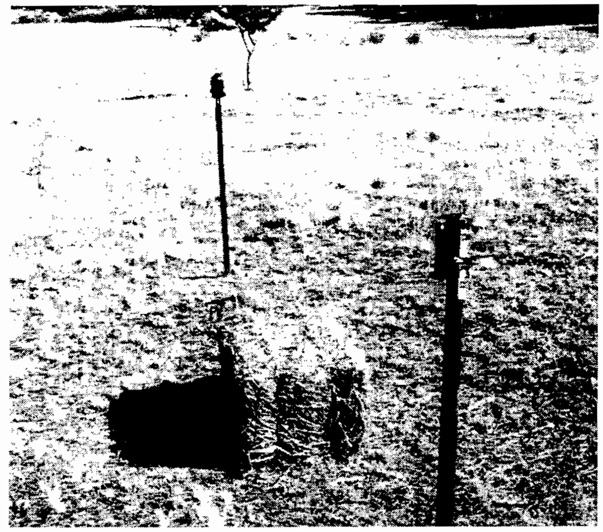

Figure 1. A protected test bale of alfalfa placed within sensory range of 2 Critter Gitters™, Estes Park, Colorado, USA, 2001.

We conducted the study on 5 independent sites (>300 m apart, not visible from each other) in pastures on a private ranch abutting residential areas of the city of Estes Park, Colorado, USA. We selected sites based on similar vegetation, topography, and proximity to timber. Each site contained 2 bales of alfalfa situated 60 m apart. We randomly applied 1 of 2 treatments (1 or 2 devices) to 1 bale and no treatment to the other. On sites 1 and 2, a single device was centered on the top of the bale with its motion sensor and speaker directed upward. On sites 3–5, we used 2 devices mounted 1 m high on metal T-posts, 2 m from each end of the bale with sensory fields centered on the bale (Figure 1). Devices triggered only when animals were ≤ 2 m from the bale.

On 10 check days (every 2–3 days), we visually inspected the bales and recorded whether hay consumption had occurred since the previous check day. We estimated hay consumption (percentage of bale consumed to the nearest 5%) based on on-site visual comparisons of the test bale to an undamaged bale. We then calculated the amount of consumption (kg) by multiplying the percentage missing by an average bale weight of 29.3 kg. We practiced estimating missing percentages of bales prior to the study and our estimates were consistent within and among observers. On each check day, we tested devices to ensure consistent and comparable performance. At the conclusion of the study, we used a decibel meter (Impulse Precision Sound-level Meter T1200, Bruel and Kjaer, Naerum, Denmark) to determine whether the device's alarm output was similar to what the manufacturer reported.

To document reactions of animals to the devices, throughout the study we monitored protected and unprotected bales on 2 randomly selected sites with motion-activated video systems (Trailmaster® TM 700v, Goodson & Associates, Inc., Lenexa, Kans.). The video systems consisted of passive-infrared sensors that operated video cameras (Sony Handycam®, Sony Corporation, Tokyo, Japan) and red-filtered lights that illuminated when systems were activated during darkness. Once activated, the systems would record as long as the animal remained active within a 12-m sensory zone.

We evaluated a research hypothesis that Critter Gitters would reduce hay consumption by testing a null hypothesis that consumption would not differ among treatment levels (0, 1, and 2 devices/bale). We modeled hay consumption as a function of site, treatment, day, and all interactions (PROC MIXED, SAS Institute, Inc. 2003). We accounted for repeated measures on experimental units (bales) by modeling correlation among measurement occasions (days) using a generalized auto regressive structure to account for unequal measurement intervals (spatial power law, Littell et al. 1996).

Results

We recorded data from the 5 sites on 10 check days. On the first 2 and last check days at Site 1, and the last 2 check days at Site 2, the devices were not functioning properly, so data from these days were not included in the analyses. We conducted 15 inspections on protected and unprotected bales with 1 Critter Gitter and 30 inspections on those with 2 Critter Gitters. On sites with 1 Critter Gitter, we documented consumption on protected bales on 5 of 15 inspections (33%) and consumption of unprotected bales on 8 of 15 (53%) inspections. On sites with 2 Critter Gitters, we found equal damage frequency on protected and unprotected bales, with consumption occurring on 13 of 30 (43%) inspections. We found no differences in estimated consumption of bales ($F_{2, 51.8}=0.37, P=0.691$; Table 1, Figure 2) protected with 1 device ($\bar{x}=4.48$ kg, SE $=2.31$, $n=15$), 2 devices ($\bar{x}=4.58$ kg, SE$=1.70$, $n=30$), or 0 devices ($\bar{x}=5.04$ kg, SE$=1.42$, $n=45$).

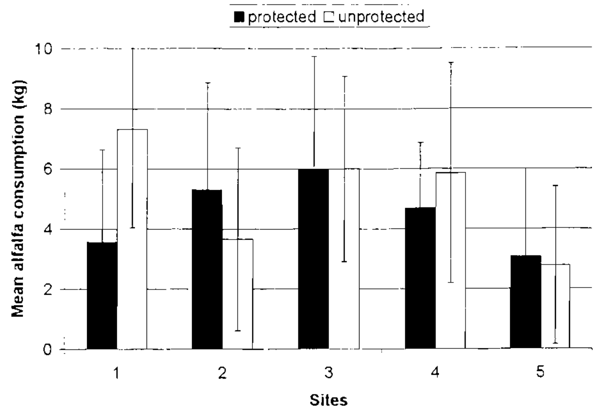

Figure 2. Mean consumption (SE) by elk and mule deer on 5 protected and 5 unprotected bales of alfalfa, Estes Park, Colorado, USA, 2001.

Video data from protected bales showed mule deer to be momentarily startled by the device on 6 of 29 (21%) recorded events, but they were never deterred from feeding. Elk were never observed to be startled in 15 recorded events. Elk or mule deer fed on bales while the device was activated during all 44 recorded events (Figure 3).

Discussion

We found Critter Gitters to be ineffective for deterring elk and mule deer from feeding. Variability in consumption amounts, though not significant, likely was due to the itinerant feeding habits of elk rather than effects of the device. We are confident that our visual estimates of consump-

Table 1. Repeated-measures analyses of hay consumption at bales protected by 1, 2, or 0 Critter Gitters™, Estes Park, Colorado, USA, 2001.

Effects	F	df Numerator	df Denominator	P
Day	5.22	1	51.1	0.027
Site	0.16	4	52.9	0.960
Treatment	0.37	2	51.8	0.691
Day × Site	0.14	4	49.7	0.966
Day × Treatment	0.56	2	49.8	0.572
Treatment × Site	0.06	3	52.8	0.979
Day × Treatment × Site	0.35	3	48.7	0.789

Figure 3. Elk and mule deer visiting sites protected by Critter Gitters™, Estes Park, Colorado, USA, 2001.

tion adequately reflected actual consumption. We may have amassed more accurate consumption data had we determined the weight and moisture content of bales at the beginning and end of each check period, correcting for moisture content at the end of a check period, and subtracting this value from the beginning weight to determine amount consumed. As correcting for moisture level changes in bales would have been problematic and labor-intensive, for the scope of this study we opted to visually estimate consumption.

We recorded 44 events on video of elk or mule deer feeding on protected bales while devices were activated and found no deterrence of consumption by the alarm and flashing red lights. White-tailed deer do not have the visual capability to see red light (VerCauteren and Pipas 2003), and VerCauteren et al. (2003) reported that white-tailed deer did not react to red laser light. Consequently, it was unlikely that elk or mule deer could see the red lights of Critter Gitters. The manufacturer stated that the output of the device approached 120 decibels. We found this to be true when the device was within 0.5 m of the decibel meter.

We observed elk and mule deer in our study to regularly be <50 m from human dwellings, vehicles, and livestock. Others also have observed elk (Singer et al. 2002) and mule deer (Wolfe et al. 2004) in this area to commonly be close to dwellings. The comfort level of these cervids with the sights and sounds of human habitation may account for their lack of response. Critter Gitters may be more effective on elk and deer that are not habituated. One problem we encountered with the Critter Gitters was that they were occasionally triggered by non-animal-related stimuli, possibly changes in ambient temperature or solar radiation. By activating when animals were not feeding on protected bales, nearby elk and deer may have habituated to the alarms more quickly than would have occurred if the devices activated only in their presence.

Other frightening devices reported to be ineffective include propane cannons (Koehler et al. 1990, Gilsdorf et al. 2004*a*), lights (Koehler et al. 1990), ultrasonic noise makers (Curtis et al. 1997, Belant et al. 1998), and some multi-stimuli devices (Roper and Hill 1985, Koehler et al. 1990, Belant et al. 1998). A common problem with many frightening devices is the short duration of efficacy due to rapid habituation by the target species (Gilsdorf et al. 2003). Others have recommended and documented several general methods for improving efficacy of frightening devices, including use of a variety of stimuli (Shivik and Martin 2000, Beringer et al. 2003), frequent movement of devices (Koehler et al. 1990), and that devices be animal-activated (Belant et al. 1996, 1998; Beringer et al. 2003). As Critter Gitters were animal-activated, they had potential to provide protection to alfalfa bales from elk and mule deer. However, because they failed to protect the hay, we speculate that they also would be ineffective in deterring elk or mule deer from feeding in gardens, golf courses, ornamental plantings, fertilized lawns, or other similar areas.

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