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# An analysis of human–black bear conflict in Utah

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***Abstract:*** Conflict between black bears (*Ursus americanus*) and humans has occurred in Utah, but the records are largely incomplete. To document these events, the Utah Division of Wildlife Resources initiated a black bear sightings and encounters database in 2003, and we updated it. From 2003–2013, there were 224 recorded events, with 10 attacks, 208 property damages, and 6 vehicle collisions. Most events took place at campsites (40%). The most common season for events was summer (78%). Most conflict occurred at night. The number of events has not increased over the last 10 years, with no significant relationship between the number of events per year and drought. Most events involved single bears, and over half of events occurred when food or garbage was available for the bear.

***Key words:*** American black bear, bear attacks, database, human–bear conflict, *Ursus americanus*, Utah

Conflicts between humans and carnivores are common wherever both species exist (Kaczenskya et al. 2004, Löe and Röskaft 2004). A better understanding of where, when, and why these conflicts occur will lead to fewer conflicts, as well as conservation of the species involved. Often, conflict with carnivores results in a negative public image, thus undermining conservation efforts (Miller and Chihuly 1987, Löe and Röskaft 2004). As managers more fully understand the nature of human–carnivore conflicts, they will be better able to educate the public, make informed conservation decisions, and subsequently reduce the total number of conflicts (McCarthy and Seavoy 1992, Wilder et al. 2007).

The first step toward understanding the causes of conflict is to construct a history. A database containing information about conflict can reveal insights as to why conflicts occur (Herrero 2002, Löe and Röskaft 2004). Wilder et al. (2007) developed the National Park Service Alaska Region Bear–Human Information Management System and entered human–bear conflict data from national parks in Alaska. This information corrected previous misconceptions regarding human–bear interactions. For example, prior to the creation of the database, it was believed that there were no concentrated areas of human–bear conflict. After the database was analyzed, however, it became apparent that there were such areas. It also revealed that bears were often being fed by residents of the area. As a result, management funds were reallocated to more effective bear management programs. Stephen Herrero (University of Calgary) has also created a database to study encounters with grizzly bears (*Ursus arctos*), black bears (*Ursus americanus*), and polar bears (*Ursus maritimus*) in North America. From this, Herrero (2002) identified effective responses for a variety of encounters with different species of bears. Further, Herrero et al. (2011) studied fatal black bear attacks in North America and identified variables that correlated with increased risk of fatal attacks by black bears.

Interactions between black bears and humans have occurred in Utah, but the historical record is largely incomplete. These interactions include property damage, livestock depredation, and attacks on humans. Before 2007, a fatal bear attack had not been recorded in Utah. This changed when a black bear attacked and killed an 11-year-old boy in June 2007, on Timpanogos

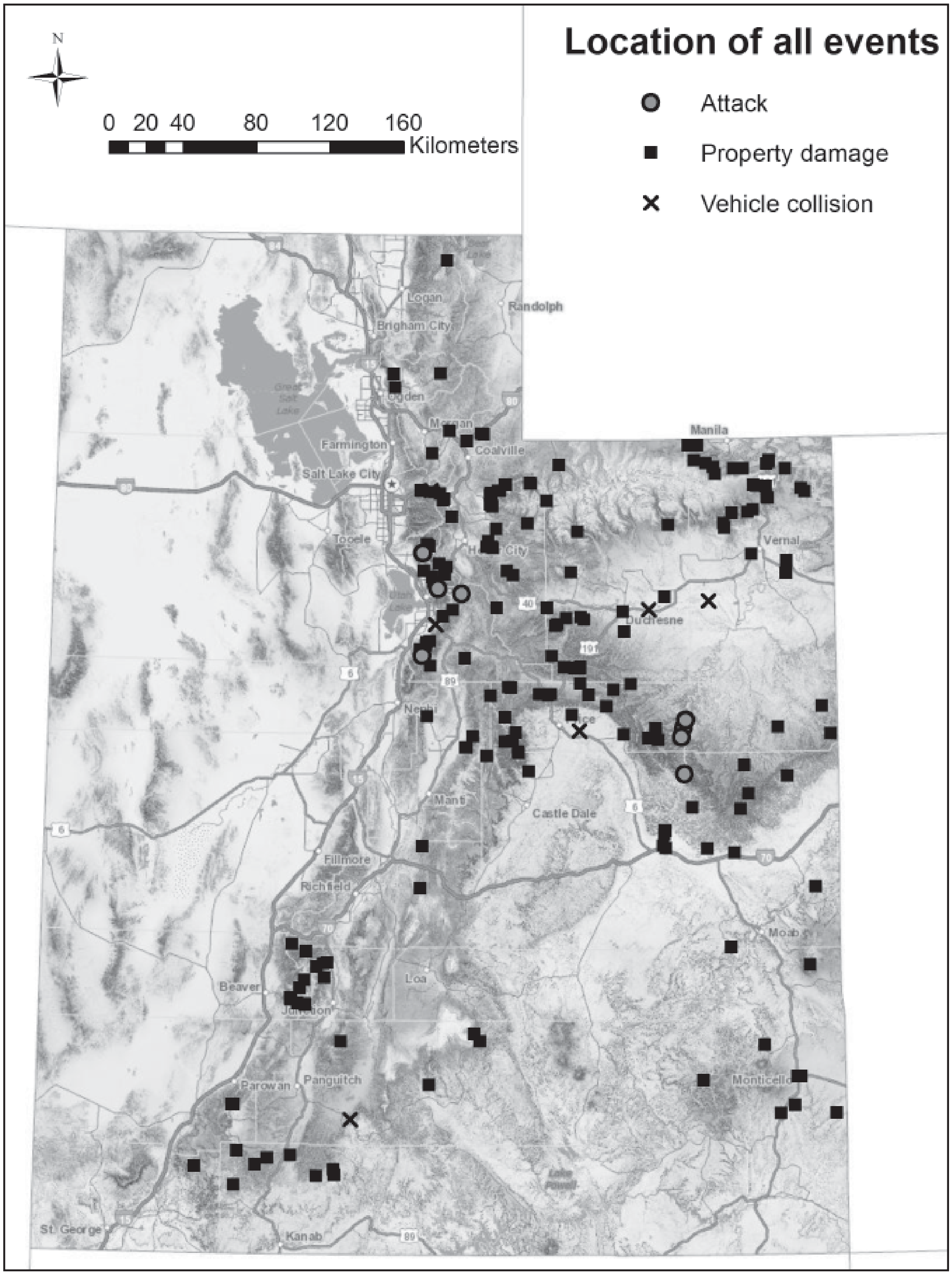


**Figure 1.** Location of all human–black bear events in Utah, 2003–2013.

Mountain in Utah County. Our objectives were to modify the database to make analysis easier, add new records, and analyze records to find common factors in conflict. Specifically, we analyzed if there has been an increase in conflicts, when and where conflicts typically occur, cohort of bear that is most often involved in conflict, and other factors that influence conflict, such as food and garbage availability.

## Methods

We contacted the Utah Division of Wildlife Resources, national parks, U.S. Forest Service, and the Bureau of Land Management to collect

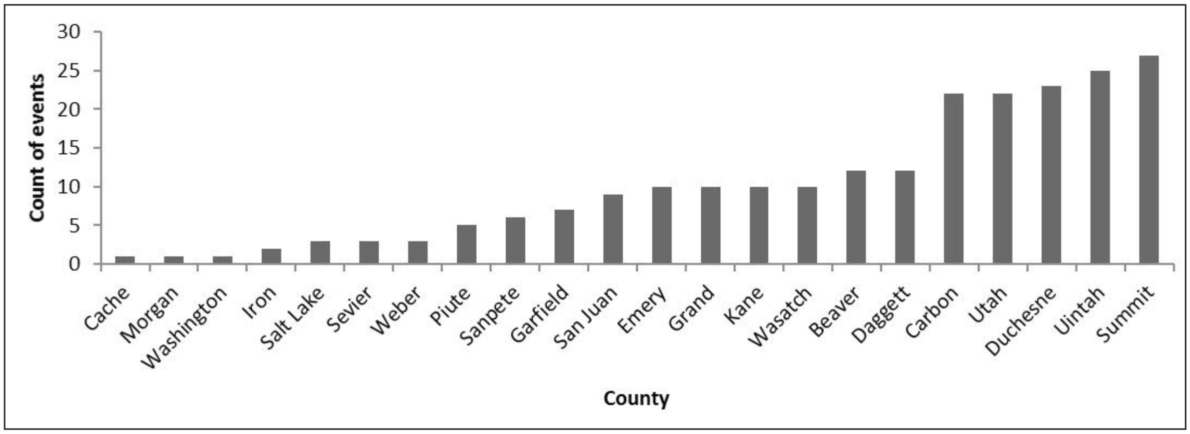


**Figure 2.** Number of human–black bear events in Utah by county, 2003–2013.

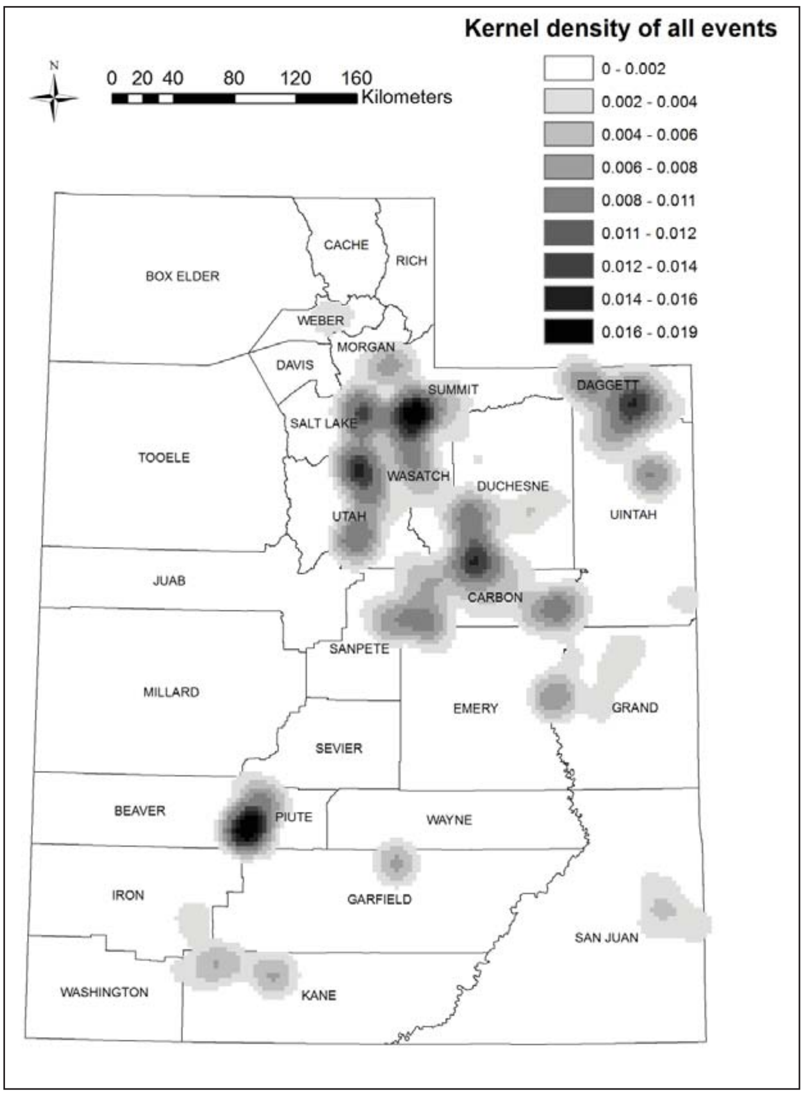


**Figure 3.** Kernel density of all human–black bear events in Utah, 2003–2013, with darker areas representing more events.

available records of human–bear conflict in Utah. We also used Google™ to search newspaper articles and hunters' blogs for incidents that occurred in Utah. Data from all of these sources were entered into the redesigned database.

We redesigned the black bear database using Microsoft Access®. We created a classification system for human–bear events, including definitions consistent with other scientists (Smith et al. 2005, Hopkins III et al. 2010). We classified events as sightings (person sees bear, and bear is apparently unaware), encounters (person and bear are mutually aware of each other, and bear approaches person, acts indifferently, or leaves), incidents (person and bear are mutually aware of each other, and bear acts aggressively but no contact), attack (person and bear are mutually aware of each other, and bear makes contact with person), property damage, (no people present, and bear damages property of person), and vehicle collision with bears. Other fields in the database included date, time, location, primary person involved, management action, availability of food or garbage, and notes specific to the event. Food or garbage included human food and garbage as well as livestock, edible agricultural products, and deer carcasses.

For the purposes of this study, we have only analyzed attack, vehicle collision, and property damage records from 2003–2013, as this time period had the most complete set of records. We determined the total number of events for each category (attack, property damage, and vehicle collision), as well as the effects of cohort, location, season, and time of events. We created maps of events using ArcGIS® software by ESRI and identified high conflict areas using the kernel density probabilistic contouring tool with default parameters (ESRI 2011). We also analyzed the relationship between total number of events and drought and precipitation data using the Palmer Z-index to measure drought for each event. The Palmer Z-index is used to determine how monthly moisture conditions depart from normal for each month without being affected by the month before (Palmer 1965). Drought causes masting plants to produce fewer fruit and thus affects food availability for bears, which in turn is correlated with the number of human–bear events (Rogers et al. 1988, Herrero and Fleck 1989, Howe et al. 2012, Baruch-Mordo et al. 2014, Obbard et al. 2014). Historical weather data were obtained from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NOAA 2014). NOAA has divided Utah into 7 climatic regions and provided historical Palmer Index data for each of these regions. We assigned each event to 1 of these 7 regions for analysis. Weather variables that we used included the mean Palmer Index from the winter prior to the event (October to June), the spring prior to the event (March to June), and the month of the event. The mountains in Utah receive most of their precipitation in the form of snow, which is why we included variables from October to June. However, we also wanted to test the effect of spring precipitation, so we included data from March to June. We also included data from the month of the event to test the effect of drought during the time of the event. In addition, we explored potential relationships between the total precipitation for the winter and spring prior to the event. Precipitation data were obtained from the Northwest Alliance for Computational Science and Engineering (NACSE 2013). All drought and precipitation variables were tested using linear regression to determine whether water conditions correlated with number of events per year. All statistical analyses were performed using Program R v2.15.2 (R Development Core Team 2011). Statistical significance was set at $\alpha \leq 0.05$.

## Results

For the years 2003–2013, 224 events were recorded. These records included 10 attacks, 208 property damages, and 6 vehicle collisions. Most of these events occurred in Utah's central and eastern mountain ranges (Figure 1).

Summit county had the highest number of events ($n$ = 27) followed by Uintah ($n$ = 25), Duchesne ($n$ = 23), Utah ($n$ = 22), and Carbon ($n$ = 22) counties (Figure 2). We found no relationship between mean human population and total number of human–bear events by county for 2003–2013 (linear regression, $\beta = \leq -0.01$, $P = 0.81$). Areas with the highest density of events included northern Utah County, Beaver/Piute counties, Summit/Wasatch counties, and Daggett/Uintah counties (Figure 3). The highest number of attacks occurred on the Green River in Carbon and Uintah counties ($n = 4$). The highest incidence of property damage occurred in Summit county and Beaver/Piute county. These events included damage to livestock, agriculture (crops such as corn, watermelon, and fruit trees), cabins, and campsites. When we specifically looked at events that had damage to livestock and agriculture, the greatest occurrence was around Green River, Utah.

From 2003–2013, most events took place at established and dispersed campsites (40%, $n = 89$) and cabins (30%, $n = 68$). Campsites were also the most common location for individual events with the exception of vehicle collisions (Table 1). All 10 attacks and 38% ($n$ = 79) of property damages occurred at campsites. Each year had campsites as one of the highest places for proportion of events to occur with the exception of 2013 where only 14% of events occurred in campsites (Figure 4).

Summer (June to August) was the most common season for events ($n$ = 174), followed by fall (September to November; 28), and then

**Table 1.** Number of human–black bear events by area use and event type.

| Area use | Attack | Property damage | Vehicle collision |
|---|---|---|---|
| Unknown | 0 | 0 | 0 |
| Agricultural | 0 | 9 | 0 |
| Cabin | 0 | 68 | 0 |
| Campsite | 10 | 79 | 0 |
| Other | 0 | 2 | 2 |
| Rural residential/urban | 0 | 34 | 2 |
| Wilderness | 0 | 16 | 2 |

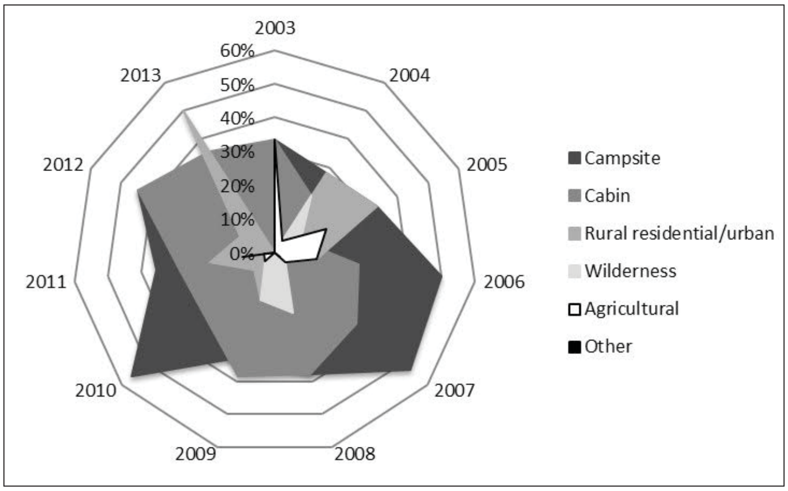


**Figure 4.** Percentage of human–black bear events by area use from 2003–2013.

spring (March to May; 22). No events occurred in winter (December to February) as bears were hibernating during this time. The time of day for many events was not reported (58.5%, $n$ = 131). For events that had a time of day reported, the highest number occurred at night (60.2%, $n$ = 56), followed by morning (sunrise to 1200; 17.2%, $n$ = 16), and then afternoon (1201–1800; 14.0%, $n$ = 13). The fewest number of events occurred during the evening (1801 to dark; 8.6%, $n$ = 8). Eight of 10 attacks occurred at night.

The mean annual number of events was 20 ± 13. The number of events that occurred in any given year was not significantly correlated to year (linear regression, $\beta$ = 0.63, $P$ = 0.65), meaning that the number of events has not increased or decreased in the last 10 years (Figure 5). For each climatic region, the year with the highest number of events was also a year of drought. However, there was no significant relationship between drought or precipitation data and the total number of events in a year (linear regression, October to June Palmer Index: $\beta$ = -0.20, $P$ = 0.74; March to June Palmer Index: $\beta$ = 0.02, $P$ = 0.97; monthly Palmer Index: $\beta$ = 0.11, $P$ = 0.77; October to June precipitation: $\beta$ = 0.07, $P$ = 0.64; March to June precipitation: $\beta$ = 0.28, $P$ = 0.38).

Single bears were involved in events 82% of the time ($n$ = 184). Most were single bears of unknown sex (70.5%, $n$ = 158). Females with young were involved in events 5% of the time ($n$ = 12). All 10 attacks involved single bears (2 males, 1 female), and the other 7 single bears were of unknown sex. Single bears were involved in 81% of property damage events ($n$ = 168).

Food or garbage was involved in 81% of events. These events may be underreported due to reluctance of people to offer up information that implicates improper behavior on their part. In addition, out of 56 events that occurred at night, 46 events involved food or garbage. Out of 224 records, 27 events resulted in the bear being killed either by the person involved ($n$ = 7) or by management ($n$ = 20). Of these 27 events, 74.1% ($n$ = 20) involved food or garbage.

## Discussion

Food or garbage was involved in most human–bear conflict events in Utah. Food was stored improperly in 30% of incidents in Great Smoky Mountains National Park (Singer and Bratton 1977). Similarly, food or garbage was noted in 25% of black bear incidents in Alberta (Herrero and Higgins 2003). When looking at attacks in the United States and the provinces and territories of Canada, Herrero et al. (2011) found that 38% of attacks were likely influenced by the presence of human food or garbage. This suggests that more secure handling of anthropogenic foods

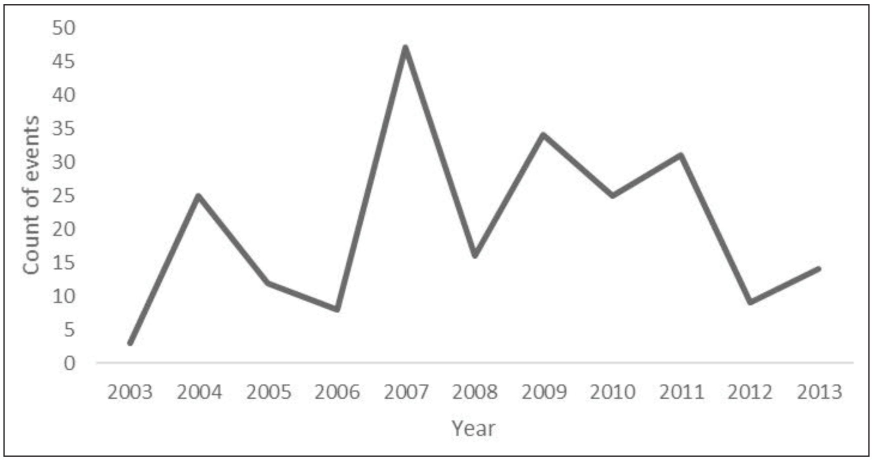


**Figure 5.** Count of total number of human–black bear events by year, 2003–2013.

in areas such as campsites, cabins, and parks would reduce the number of human–bear conflicts in Utah. Such is the case in Canada where proactive food and garbage measures have greatly reduced food-conditioning in bears (Herrero 2002). Areas such as orchards and fields can be protected with electric fencing (Jonker et al. 1998), and these options should be evaluated for efficacy in Utah.

In areas of low human use, black bears are typically diurnal or crepuscular (Amstrup and Beecham 1976). However, where time of day was known, most human–bear conflict events in Utah occurred at night. Specifically, 8 of 10 attacks happened at night, and the other 2 attacks occurred in the early morning hours. When comparing bears that foraged on natural foods to bears that foraged in campgrounds, Ayres et al. (1983) found that bears that foraged on natural foods were crepuscular and diurnal, whereas bears that foraged in campgrounds were nocturnal, presumably to avoid detection while foraging in the midst of a campground. Baruch-Mordo et al. (2014) also found that in poor food years, bears used higher human density areas and became more nocturnal. In contrast, most bear-inflicted injuries in British Columbia and black bear attacks in North America took place during the day, between 1600 and 1800 hours (Herrero and Higgins 1998, Herrero et al. 2011). Our data, however, show that human–bear conflict in Utah typically occurs at night, likely because this is when bears can avoid detection by people while searching for food.

Most Utah events involved a single bear of unknown sex. All 10 attacks on humans involved a single bear, which is consistent with other findings (Herrero and Higgins 1998, Herrero and Higgins 2003). However, Utah black bear attacks differ from those involving grizzly bears where females with dependent young caused the most injuries (Herrero and Higgins 1998, Herrero 2002).

Most events occurred at campsites, and all 10 Utah attacks occurred at campsites. Herrero and Higgins (2003) also found that hiking, walking, and camping were common activities preceding both black and grizzly bear-inflicted injuries. It is likely that campsites are the most common place for human–black bear events in Utah because they are foci for anthropogenic foods.

We found no significant relationship between drought and the number of events in a year. This was contrary to the reports of others who have found drought to cause food stress for bears, thus increasing the likelihood that they would seek out other food sources (Rogers et al. 1988, Herrero and Fleck 1989, Zack et al. 2003, Baruch-Mordo et al. 2014) and the number of human–bear conflict events (Baruch-Mordo et al. 2008), but we did not find a relationship in Utah.

## Management implications

As people continue to participate in outdoor activities, it is important for them to understand how to avoid conflict with bears, for both their own safety and the conservation of bears. It is commonly known that food attracts bears, and our findings support this. This suggests that efforts to reduce human–bear conflict in Utah should focus on ways to remove bears' access to anthropogenic foods. Clearly, it is particularly important to secure food at night when bears are most active around camping and urban areas. Official campgrounds would benefit from installing bear-proof dumpsters to eliminate the food reward for bears visiting these areas. In addition, our study highlights the need for educating the public on camping in bear country. Many events occurred at dispersed campsites where people had food readily available for bears. It is important to make people aware that camping in Utah is camping in bear country, that bears must be respected, and that to do so we must properly store food and garbage.

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