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Case Study

Human–bear conflicts in Massanutten Village: achieving success requires partnerships

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Abstract: Interactions between humans and black bears (*Ursus americanus*) in Virginia, USA, increase as bear populations recover from historically low levels and expand their range to seek food in human-modified environments. In 2002, the Virginia Department of Game and Inland Fisheries (VDGIF) changed its management of human–bear conflicts from translocating bears involved in conflicts to emphasizing human behavior changes. Herein we provide an overview of human–bear conflict management at Massanutten Village (Village), a popular four-season resort with 3 ownerships. Before 2009, VDGIF received an average of 60–70 human–bear interaction complaints from the Village annually. In 2009, 2 Village ownerships replaced 175 dumpsters readily accessible to bears with bear-resistant models, and the number of human–bear conflict complaints VDGIF received from the Village decreased to an average of 10–15 calls per year (>75% reduction). The VDGIF continues to request behavior changes from the third ownership, which has not yet altered its garbage practices and cites bear translocation as a more appropriate response to its complaints. Additional legal consequences and education for human–bear conflict resolution may improve collaboration between VDGIF and the Village to achieve complete attractant management.

Key words: black bear, human–bear conflict, garbage management, Massanutten Village, partnership, *Ursus americanus*, Virginia

As growing human populations encroach on natural areas, some wildlife populations habituate to human-modified environments, often increasing proximity and unwanted interactions between humans and wildlife. These unwanted interactions are known as human–wildlife conflicts. Rockingham County (Figure 1), located in northwestern Virginia, USA, is home to Massanutten Village (hereafter Village), a four-season resort that receives approximately 2 million visitors per year (J. Gordon, Massanutten Police Department, unpublished data), and a dense black bear (*Ursus americanus*) population estimated at 0.67–1.09 bears/km^2 (Carney 1985, Klenzendorf 2002). The proximity of a major tourist attraction, and the fifth largest employer in the county (Virginia Labor Market Information 2018), to a significant population of a large opportunistic omnivore creates potential for human–bear conflicts. Herein we provide an overview of the history and future of human–bear conflict management at the Village.

Study area

Rockingham County contains a matrix of private and public land delineated primarily by the location of mountains. The George Washington National Forest (GWNF) occupies much of the Allegheny Mountains, which compose the western portion of the county. The county's eastern border follows the ridgeline of the Blue Ridge Mountains and contains a portion of Shenandoah National Park. Between these mountain ranges lies the Shenandoah

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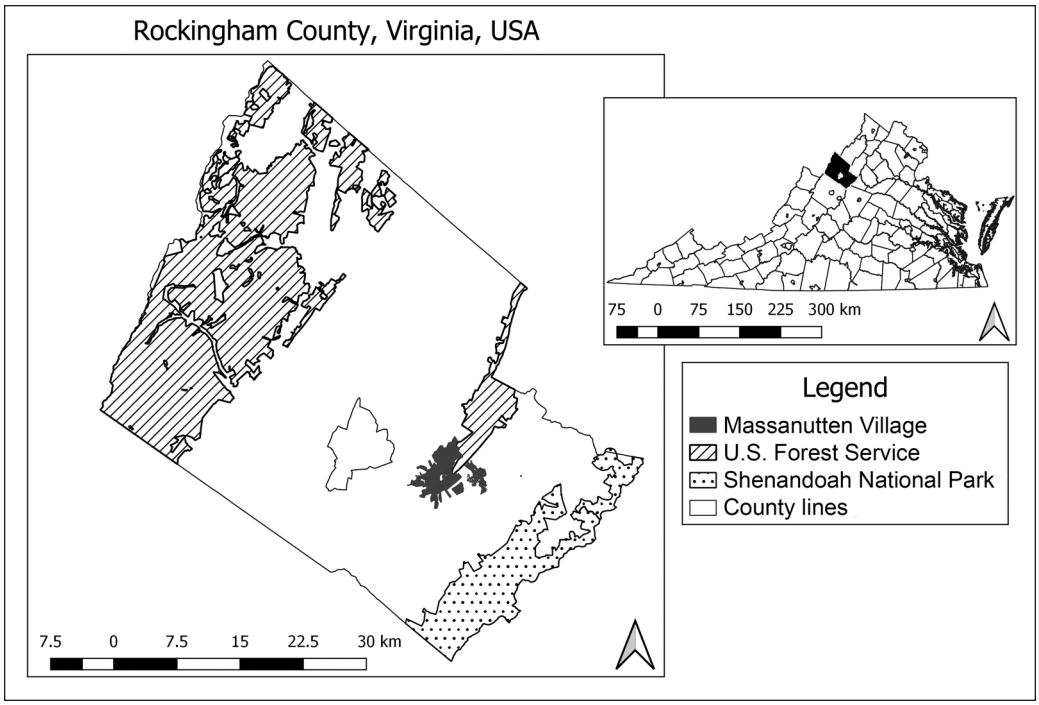

Figure 1. Rockingham County, Virginia, USA. Massanutten Village is located at the southern tip of Massanutten Mountain and bordered to the northeast by U.S. Forest Service. Administrative boundary data courtesy of Rockingham County, Virginia and parcel data courtesy of Virginia Information Technologies Agency (*created by A. Scott*).

Valley. The Massanutten Mountain range, approximately 80 km long and 6.4 km wide, runs parallel to the Allegheny and Blue Ridge Mountains, and after bisecting the northern Shenandoah Valley, ends in north-central Rockingham County. A Geographic Information System analysis indicates that the U.S. Forest Service owns approximately 55% of Massanutten Mountain, and the remaining portion is privately owned (J. O'Hear, U.S. Forest Service, unpublished data). Rockingham County's population, concentrated primarily in the Shenandoah Valley, is approximately 80,227 persons (U.S. Census Bureau 2017).

The Village encompasses an area of >3,643 ha at the southernmost tip of Massanutten Mountain, bordered to the north by GWNF. Within the Village, 3 ownerships have developed approximately 2,428 ha for recreation and residential use. Massanutten Resort (MR) owns approximately 2,200 condominiums and provides a variety of recreational opportunities including snow sports, golf, and a year-round waterpark. Mountainside Villas (MV) manages an additional 175 condominiums, and the Massanutten Property Owners Association (MPOA) oversees approximately 1,100 private homes. Organized hunting of any species is prohibited in the Village, though hounds may occasionally cross the undeveloped portion when actively pursuing a bear from nearby U.S. Forest Service lands (K. Dean, Massanutten Resort, unpublished data).

Bear management in Virginia

Black bears were nearly extirpated from Virginia by 1900 due to overexploitation and habitat loss, and while hunting regulations established in the first half of that century allowed Virginia bear populations to persist, the state agency maintained bears at low populations to minimize agricultural depredation events (VDGIF 2002, 2012).

Bear hunting involving archery, muzzle loading, and modern firearms (with and without dogs) occurs across Virginia with a bag limit of 1 bear per year (VDGIF 2002). Since 2008, Virginia's black bear harvest has exceeded 2,000 bears annually, reflecting an increasing trend in bear populations across the commonwealth (VDGIF 2012). In the absence of intensive population studies, harvest densities

serve as a relative indication of population density (VDGIF 2002). Rockingham County has sustained a robust bear population, consistently leading the commonwealth in the number of bears harvested and accounting for 179 of 2,860 bears (6.3%) harvested in 2017 (J. L. Sajecki, VDGIF, unpublished data). These figures corroborate with the specific density estimates (Carney 1985, Klenzendorf 2002).

In the 1970s, VDGIF began intensive efforts to recover black bear populations across the commonwealth by closing counties with low bear densities to bear hunting, abolishing bear bounties, and shortening remaining bear seasons to reduce the hunting mortality of female bears, thus stimulating population growth (VDGIF 2002). Throughout the recovery period (1970–2002), VDGIF often trapped and translocated bears involved in conflicts with humans, including depredation and property damage involving garbage, to supplement low bear populations elsewhere in Virginia as described by Fies et al. (1987; VDGIF 2002). Between 1980 and 2002, VDGIF translocated an average of 50 bears annually, a period over which the number of human–bear interaction complaints to VDGIF increased from approximately 40 to 110 annually (VDGIF 2002).

Due to the large expense required for each translocation, negative health and survival effects of translocation to bears, tendencies for translocated bears to return home and continue exhibiting conflict behavior, and the ineffectiveness of this strategy for resolving the circumstances that created the conflict, VDGIF shifted its focus for human–bear conflict management from translocating bears to managing bears in place with the completion of its first 10-year Black Bear Management Plan (BBMP) in 2002 (VDGIF 2002). The plan used a stakeholder involvement process to consider positive demands (i.e., hunting and viewing opportunities) with negative demands (i.e., conflict behaviors) for black bear populations and identify areas where VDGIF should increase, decrease, or stabilize (maintain near existing numbers) bear populations (VDGIF 2012). By 2000, bear population density in Rockingham County was increasing. The 2002 BBMP directed VDGIF to stabilize bear populations in the county and in 16 of 22 (73%) bear management zones (VDGIF 2002). The most recent BBMP indicated that Rockingham County's bear population continued to increase, and the VDGIF renewed plans to stabilize it (VDGIF 2012).

Human–bear conflict management – Massanutten Village

Development of the Village began in the early 1970s, during the same period that conflict bears were trapped and translocated to other parts of the commonwealth. When VDGIF's full-time trapper retired without replacement in 2002, the agency's district wildlife personnel assumed responsibility for human–bear conflict management by responding to complaints and providing suggestions for human behavior change to resolve problems. In 2003, MR contacted VDGIF regarding unwanted bear presence and behavior at the Village. Consistent with the new BBMP, VDGIF responded with a letter explaining that the conflict originated with poor garbage management and provided various suggestions for its resolution, including changes to dumpsters. Later that year, VDGIF passed a regulation making it illegal to intentionally or unintentionally feed black bears on private lands to complement a similar provision for public lands from 1999. In 2006, the Massanutten Police Department (MPD) reported a bear routinely feeding in and acting aggressively near a dumpster to VDGIF. In response, VDGIF translocated 1 bear and sent letters to MR, MV, and MPOA explaining the new feeding regulation and behavior-based methods to prevent human–bear conflicts. Each entity responded with plans and timelines for addressing the garbage-related conflicts that year. The MR changed 3 dumpsters and pledged to change the remainder within the year. The MPOA planned future changes to dumpsters, but did not address household garbage from individual homeowners, and MV considered several bear-resistant dumpster designs. In 2007, MR added a VDGIF-produced educational video about black bears that highlighted garbage management to its information cable channel.

In January 2009, MPD killed a bear thought to have threatened an officer after feeding in a dumpster. The VDGIF staff that visited the location after the incident reported improperly stored garbage at several sites. Later that month, MPD contacted VDGIF about a large

male bear in garbage, which VDGIF trapped and translocated. Within days of this incident, VDGIF followed up with in-person visits and delivered letters suggesting possible legal action due to the lack of significant changes to garbage management by all 3 ownerships. When MPD contacted VDGIF again that month regarding another garbage-related bear conflict, VDGIF reiterated the need for human behavior change and declined to remove the bear. After VDGIF threatened legal action and suggested possible liability issues, MR received a quote of $50,000 to retrofit old dumpsters to make them bear-resistant (M. Callahan, Clark and Bradshaw, P.C., unpublished data). Later in 2009, the MR replaced its 140 (88%) dumpsters most frequently visited by bears with bear-resistant models and planned to replace remaining dumpsters in the future (T. Thompson, MR, unpublished data). That year, MV retrofitted its 35 (100%) dumpsters.

The Villager, a local news publication at the Village, published articles on the human–bear conflicts in February 2009. In response to the publicity, the MPOA Board reiterated its position that VDGIF must relocate conflict bears and that MPOA did not claim responsibility for garbage management by individual homeowners. The VDGIF emailed MPOA and MR in March 2009 to remind them of increases in bear activity expected with warmer weather, suggest appropriate garbage management, and communicate an expectation that MPD issue citations to individual homeowners violating garbage management practices. In response, MPOA suggested that VDGIF, not MPD, should take responsibility for issuing citations while also translocating conflict bears. In 2010, the Virginia General Assembly passed legislation to codify VDGIF's ability to regulate feeding of wildlife, strengthening VDGIF's regulations against feeding bears.

Results and discussion

From 2003 to 2009, VDGIF received an average of 60–70 bear-related complaints annually from the Village. After MR and MV replaced 175 dumpsters with bear-resistant models, the average number of complaints decreased to 10–15 per year (>75% reduction) and originated primarily on MPOA private homeowner properties (D. Kocka, VDGIF, unpublished data). Remaining complaints from MR and MV typically involved bears intentionally fed by visitors to the Village rather than bears accessing garbage. The VDGIF continues to work with MPOA to require adequate garbage management by individual homeowners through discussions and educational seminars. To date, MPOA and MPD have not issued citations for improper garbage management by individual homeowners. They continue to emphasize that responsibility lies with VDGIF to trap and remove bears involved in conflicts. Bears continue to investigate residential areas for accessible garbage, bringing them into proximity with humans.

Previous studies demonstrate that proper garbage management can reduce human–bear conflicts (Baptiste et al. 1979, Garshelis 1989, Keay and Webb 1989, Barrett et al. 2014). These findings correlate with the reduction in calls to VDGIF after MR and MV installed bear-resistant containers. While we acknowledge that the reduction could reflect other influences, such as ownerships declining to call VDGIF for fear of additional liability warnings, using the relative number of complaints is an acceptable and therefore important measure of conflict management for an agency with limited resources (VDGIF 2002). Future efforts to quantify success could use methods such as telephone surveys (Barrett et al. 2014) to provide a more robust measure of management effectiveness.

Human–bear conflicts involving garbage on MR and MV properties reflected the use of bear-accessible dumpster designs and were mitigated by implementing bear-resistant dumpsters. As a decentralized issue, improper garbage storage by individual homeowners on MPOA properties is more challenging to correct. Although VDGIF has legally restricted all feeding of bears, including leaving garbage accessible to bears, potential liability may be a greater motivator for compliance than threat of a misdemeanor feeding regulation, as demonstrated by the 2009 response of MR and MV to VDGIF's threat of legal action. The maximum penalty assigned for violating this Class 3 misdemeanor regulation ($500) may not be sufficient to encourage behavior changes. Reluctance of local authorities to enforce feeding restrictions and the lack of resources available

to VDGIF to monitor and issue citations to individual violators limit implementation of improved garbage management. The precedent for translocating bears set by pre-2002 bear management and subsequent responses to Village complaints contributes to perceptions that VDGIF can and should translocate all bears close to human developments.

Management implications

Building partnerships between VDGIF and the Village provided the most successful long-term mitigation of human–bear conflicts at Massanutten Village. These entities must clarify expectations and responsibilities for implementing garbage management and enforcing feeding regulations. One solution may involve sharing the responsibility for issuing citations between VDGIF and MPD. More severe penalties for feeding bears, such as increased fines, may be required to change the behavior of violators. Additionally, education efforts that encourage responsible human behavior and publicize the consequences of poor garbage management for both humans and bears should be continued. The Massanutten Village case study underscores the importance of cooperation between wildlife agencies and their constituents in maintaining healthy wildlife populations and encouraging coexistence between humans and bears.

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