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Research Note

A Tool Box Half Full: How Social Science can Help Solve Human–Wildlife Conflict

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There is a growing recognition among wildlife managers that focusing management on wildlife often provides a temporary fix to human–wildlife conflicts, whereas changing human behavior can provide long-term solutions. Human dimensions research of wildlife conflicts frequently focuses on stakeholders' characteristics, problem identification, and acceptability of management, and less frequently on human behavior and evaluation of management actions to change that behavior. Consequently, little information exists to assess overall success of management. We draw on our experience studying human–bear conflicts, and argue for more human dimensions studies that focus on change in human behavior to measure management success. We call for help from social scientists to conduct applied experiments utilizing two methods, direct observation and self-reported data, to measure change in behavior. We are optimistic these approaches will help fill the managers' tool box and lead to better integration of human dimensions into human–wildlife conflict management.

Keywords black bear, human dimensions, human–wildlife conflict, management efficacy, conflict management

Human–wildlife conflict impacts species conservation, jeopardizes human livelihood and safety, and requires increased resources from managers (Woodroffe, Thirgood, & Rabinowitz, 2005). Research devoted to solving human–wildlife conflict has tended to focus on managing wildlife (e.g., Smith, Linnell, Odden, & Swenson, 2000a; Smith, Linnell, Odden, & Swenson, 2000b). There is an increasing recognition, however, that solutions focused on wildlife alone limit managers' ability to effectively resolve conflicts, implying a need to focus management solutions on humans as well. Social scientists trained in persuasion theory (e.g., Crano & Prislin, 2006), conflict resolution (e.g., Rauschmayer & Wittmer,

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2006), and human conditioning (e.g., Zinn, Manfredo, & Decker, 2008), for example, are well suited for studying human behavior. In this article we suggest that social scientists can help wildlife managers find effective conflict solutions by conducting research focused on evaluating management actions aimed at changing human behavior.

Our views on integrating human dimensions into conflict management stem from our urban black bear (*Ursus americanus*) ecology research in Colorado, which included an evaluation of the efficacy of education and enforcement as management tools in reducing human–bear conflicts (Baruch-Mordo, unpublished data). In conflict situations, bear management actions typically include aversive conditioning, translocation, and lethal control. Such actions, however, are frequently short-term solutions (e.g., Beckmann, Lackey, & Berger, 2004; Linnell, Aanes, Swenson, Odden, & Smith, 1997), and managers are increasingly recognizing that solutions to human–bear conflict must focus on limiting the availability of anthropogenic food to bears (Spencer, Bausoleil, & Martorello, 2007).

Management actions directed at changing human behavior include education and law enforcement. Managers often employ "Bear Aware," "Bear Smart," and "Bear Wise" education campaigns that require considerable material and labor to educate people and reduce the availability of garbage to bears (Peine, 2001). In Whistler, British Columbia, for example, the 1998 black bear management plan budgeted for over $30,000 CAD to cover advertising, brochures, signs, and sticker costs (Black Bear Task Team, 1998). Despite these campaigns and dollars spent, however, the efficacy of such management tools in changing human behavior remains largely unknown (Gore, Knuth, Curtis, & Shanahan, 2006). Managers are left with little information for gauging the costs, benefits, and overall success of these actions.

Human dimensions research on wildlife conflict management includes: (a) problem identification and development of objectives, (b) formulation of management alternatives, and (c) evaluation of the success of management actions (e.g., Ring, 2008; Treves, Wallace, Naughton-Treves, & Morales, 2006). The first two steps focus management actions on best serving constituencies and include topics such as identification of stakeholders, their characteristics, values, attitudes, and acceptability of different management actions. A review by Vaske, Shelby, and Manfredo (2006) revealed that most research published in *Human Dimensions of Wildlife* has focused on attitudes, beliefs, values, norms, and satisfactions (62%), as compared with behavior-related research (18%). Understanding attitudes and beliefs provides valuable knowledge of constituencies and management alternatives. Attitudes and beliefs can in some cases be correlated with behaviors such that indirect prediction of behavior and behavior change is possible (Manfredo, 2008), but in other cases correlations are weak, and only direct measures of behavior (i.e., step (c) above) will be effective (McCleery, Ditton, Sell, & Lopez, 2006). It is this latter case that argues for more wildlife management research on changes in human behavior and, in particular, how to directly change it to solve wildlife conflicts.

Two methods are currently employed to measure the success of management actions in changing human behaviors: direct observation of human behavior and self-reported behavior (i.e., survey data). Observation data directly measures changes in human behavior to answer the question, was management successful? In the context of human–bear conflicts, for example, making trash unavailable to bears by properly securing trash containers is a direct measure. Self-reported data measure human behavior change via interviews or questionnaires and provide insight into the human perspective of a management issue. For example, what aspect of a "Bear Aware" sign attracted attention and caused a subsequent change in behavior? Because self-reported data can be prone to sampling biases (e.g., Treves, 2008; White, Jennings, Renwick, & Barker, 2005) and most wildlife managers are

typically not equipped to conduct such evaluations (Gigliotti & Decker, 1992), wildlife managers must rely on the help of social scientists working on human dimensions of wildlife issues to collect self-reported data for evaluating success in changing human behavior.

Both data collection methods are most informative where management actions are applied as experimental treatments. Sampling pre- and post-treatment application in both control and treatment sites is recommended (Underwood, 1994) due to variation in natural systems that can affect wildlife behavior and subsequent conflict rates. Natural food production failures, for example, may result in hungry bears searching for alternative food sources, an increase in conflicts with humans, and subsequent reactive application of management actions directed at people. If sampling is restricted only to treatment locations and the period after treatment application, it is unclear whether an observed treatment effect is the result of the management applied or other auxiliary factors that were not accounted for. By including control sites and monitoring both treatment and control units before and after treatment application, confidence increases that the observed effect is attributable to the management solutions applied.

Our Aspen, Colorado, USA study illustrates how, without such an experimental approach, conclusions about management success would be confounded. The summer and fall of 2007 were extremely low natural food production seasons and numerous bear conflicts occurred. Pitkin County passed an emergency ordinance increasing fines for trash violations and the city of Aspen implemented an aggressive education campaign in conjunction with the Colorado Division of Wildlife (CDOW). In addition, CDOW moved or killed 35 bears from Aspen and the surrounding areas due to conflicts (K. Wright, District Wildlife Manger, personal communication). In the following summer (2008), conflict occurrence was reduced in Aspen, and many attributed the low conflict rate to the management actions. Although management actions directed at people may have changed trash-securing behaviors, confounding variables existed, mainly the large reduction in number of bears in 2008 and the variability of natural food sources (2008 was a more productive natural food year than 2007). In contrast, our preliminary data from education and enforcement experiments suggested that certain areas in Aspen regularly violated trash-securing regulations, and data from GPS-collared bears suggested that they were still using garbage resources.

The Aspen experiments that we conducted measured changes in human behavior by using direct observation of changes in trash availability to bears pre- and post-application of education and enforcement treatments. Gore, Knuth, Scherer, and Curtis (2008) provide an example of using self-reported data within an experimental design. They surveyed people's bear-related behaviors pre- and post-application of a "Bear Aware" education campaign. However, Marion, Dvorak, and Manning (2008), who experimentally examined the effectiveness of two educational treatments in reducing wildlife feeding behaviors by visitors to Zion National Park in Utah, is the only study that appears to have integrated both direct and self-reported measures. They measured human response by objectively recording exposure to the educational treatment and subsequent behaviors, and conducting a follow-up survey that assessed message retention.

As wildlife ecologists, our interest is on improving our ability to manage wildlife and realize the need to broaden our understanding of human dimensions work. We are optimistic about filling the managers' toolbox by better integrating human dimensions into the development of applicable management solutions for human–wildlife conflicts. We call on social scientists to help in this effort by implementing applied experiments that

evaluate the efficacy of management actions aimed at changing human behavior. Researchers from both disciplines should develop collaborative efforts and use both direct observations and self-reported data metrics for evaluating management actions. By doing so we will be better equipped to answer current and future needs of wildlife managers and optimize the coexistence between wildlife and people.

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