frontiers | Frontiers in Conservation Science

TYPE Original Research
PUBLISHED 09 February 2023
DOI 10.3389/fcosc.2023.1041393

OPEN ACCESS

EDITED BY
Igor Khorozyan,
Consultant in Mammal Research and Biodiversity Conservation, Germany

REVIEWED BY
Beatriz Arroyo,
Institute for Research on Game Resources (CSIC), Spain
Thomas S. Jung,
Government of Yukon, Canada

*CORRESPONDENCE
William F. Siemer
wfs1@cornell.edu

†These authors share first authorship

SPECIALTY SECTION
This article was submitted to Human-Wildlife Interactions, a section of the journal Frontiers in Conservation Science

RECEIVED 10 September 2022
ACCEPTED 20 January 2023
PUBLISHED 09 February 2023

CITATION
Siemer WF, Lauber TB, Stedman RC, Hurst JE, Sun CC, Fuller AK, Hollingshead NA, Belant JL and Kellner KF (2023) Perception and trust influence acceptance for black bears more than bear density or conflicts. *Front. Conserv. Sci.* 4:1041393. doi: 10.3389/fcosc.2023.1041393

Perception and trust influence acceptance for black bears more than bear density or conflicts

William F. Siemer[1*†], T. Bruce Lauber[1†], Richard C. Stedman[1], Jeremy E. Hurst[2], Catherine C. Sun[3], Angela K. Fuller[4], Nicholas A. Hollingshead[5], Jerrold L. Belant[6] and Kenneth F. Kellner[6]

[1]Center for Conservation Social Sciences, Department of Natural Resources and the Environment, Cornell University, Ithaca, NY, United States, [2]Division of Fish and Wildlife, New York State Department of Environmental Conservation, Albany, NY, United States, [3]Zambian Carnivore Programme, Greater Kafue Team, Mfuwe, Eastern Province, Zambia, [4]U.S. Geological Survey, New York Cooperative Fish and Wildlife Research Unit, Department of Natural Resources and the Environment, Cornell University, Ithaca, NY, United States, [5]Cornell Wildlife Health Center, College of Veterinary Medicine, Cornell University, Ithaca, NY, United States, [6]Department of Fisheries and Wildlife, Michigan State University, East Lansing, MI, United States

Introduction: To sustain black bear (Ursus americanus) populations, wildlife managers should understand the coupled socio-ecological systems that influence acceptance capacity for bears.

Method: In a study area encompassing a portion of New York State, we spatially matched datasets from three sources: human-bear conflict reports between 2006 and 2018, estimates of local bear density in 2017–2018, and responses to a 2018 property owner survey (n=1,772). We used structural equation modeling to test hypothesized relationships between local human-bear conflict, local bear density, and psychological variables.

Results: The final model explained 57% of the variance in acceptance. The effect of bear population density on acceptance capacity for bears was relatively small and was mediated by a third variable: perception of proximity to the effects of human-bear interactions. The variables that exerted a direct effect on acceptance were perception of bear-related benefits, perception of bear-related risks, perceived proximity to effects of human-bear interactions, and being a hunter. Perception of bear-related benefits had a greater effect on acceptance than perception of bear-related risks. Perceived proximity to effects of human-bear interactions was affected by local bear density, but also was affected by social trust. Increased social trust had nearly the same effect on perceived proximity as decreased bear density. Social trust had the greatest indirect effect on acceptance of any variable in the model.

Discussion: Findings suggest wildlife agencies could maintain public acceptance for bears through an integrated approach that combines actions to address bear-related perceptions and social trust along with active management of bear populations.

KEYWORDS

acceptance, bear, conflict, population density, psychological model, trust

1 Introduction

Reducing human-bear conflict has become a central component of bear management in the eastern U.S. (Organ and Ellingwood, 2000; Spencer et al., 2007; Siemer et al., 2007a). Increases in black bear (*Ursus americanus*) abundance and distribution, combined with human settlement patterns and other factors (e.g., increased anthropocentric food resources for bears) have heightened the potential for human-bear conflicts (Whitmer and Whittaker, 2001; Beckmann and Berger, 2003; Zack et al., 2003; Baruch-Mordo et al., 2008). Human-bear interactions can be attributed to multiple factors (e.g., changes in weather patterns, land use, reporting protocols, media coverage), but it has been suggested that: "…with fewer bears, it is natural to assume that there would be fewer human-bear interactions resulting in fewer complaints" (Hristienko and McDonald, 2007, page 80). Wildlife management agencies utilize regulated bear hunting or removal of individual bears to keep human-bear conflicts within limits of public tolerance (Hristienko and McDonald, 2007; Raithel et al., 2017), and hunting is an effective means to limit bear population growth (Freedman et al., 2003; Beston, 2011). In addition to hunting, many state wildlife management agencies (SWAs) strive to limit human-bear conflicts through technical guidance or public education efforts.

Findings on the relationship between regulated bear harvest and levels of human-bear conflict have been mixed. Reported human-bear conflicts did not decline following increased black bear harvests in Ontario (Canada) and Wisconsin (USA) (Treves et al., 2010; Obbard et al., 2014). During a period of rapid bear population increase in Minnesota (USA), there was an increase in human-bear conflict, but only in years when natural foods for bears were less available (Garshelis and Nocye, 2008). Investigators documented a decline in human-bear conflict reports after increased bear harvest in Pennsylvania and New Jersey (both USA) (Ternent, 2007; Raithel et al., 2017). However, in the New Jersey study decline in conflict reports might have resulted from an education effort that coincided with efforts to reduce bear density (Raithel et al., 2017). These mixed findings highlight an ongoing need to clarify the relationship between bear density and level of human-bear conflicts (Howe et al., 2010). Absence of information about bear density at small geographic scales and regional inconsistencies in records of human-bear interactions have impeded quantitative analysis of the relationship between bear density and human-bear conflicts.

Understanding the relationship between bear population density and human acceptance of bear populations would allow wildlife managers to make informed management decisions. Persistence of large carnivores like bears depends in part upon public acceptance of carnivore populations in human-dominated landscapes (Bruskotter and Shelby, 2010; Raithel et al., 2017). Human acceptance of bear populations is the product of coupled human and ecological systems, but historically the ecological and human dimensions of bear management have been studied separately. Previous studies have not spatially matched data on residents' bear-related perceptions and population preferences with data on bear density and human-bear conflicts. Integration across the human and ecological dimensions of bear management will allow wildlife managers to test long-held assumptions about the relative importance of bear density in determining human residents' bear population preferences.

Acceptance of wildlife has been defined and measured in multiple ways. Wildlife acceptance capacity (WAC) is defined as the maximum wildlife population acceptable to a stakeholder or stakeholder group and has been measured as preference for the population trajectory of a species (Decker and Purdy, 1988). Social carrying capacity (SCC) is defined not as a desired species population level, but as a level of human-wildlife interactions that meets social demand for wildlife-related benefits without exceeding social tolerance for wildlife-related costs (Peyton et al., 2001). Social carrying capacity for bears has been measured with a single indicator of sensitivity to interactions with bears at various levels of proximity and potential for human-bear conflict (Peyton et al., 2001). Researchers have also assessed acceptance by focusing on positive and negative human-wildlife interactions and their importance to individuals. This approach uses a multi-item index to determine whether the net result of important human-wildlife interactions are negative and thus exceed acceptance (Lischka et al., 2008). The various measurement approaches represent different means of representing the outcome of judgments humans make about the relative costs and benefits associated with wildlife species.

The work of three teams of scholars provides a solid foundation for research on acceptance capacity for black bears. Zajac et al. (2012) used structural equation modeling (SEM) to test a psychological model of acceptance for an emerging bear population in Ohio (USA). Their work provides tested measurement scales and support for a psychological model of acceptance that includes perceived similarity of values with the bear management agency, trust in the bear management agency, personal control over bear-related problems, and perceived benefits and risks associated with bears (Zajac et al., 2012). Lischka et al. (2019) used data from a longitudinal study of residents near Durango, Colorado (USA) to compare five *a priori* models of acceptance (i.e., psychological, impacts, values, conflict, and demographics models). Results of their linear regression analysis indicated that the psychological model best predicted acceptance (Lischka et al., 2019). Finally, Cleary et al. (2021) used SEM to investigate relationships in a psychological model of tolerance for a recolonizing population of bears in eastern Oklahoma (USA). Their work also included spatial analysis to examine tolerance in geographic areas with different levels of human population and human-bear conflict. They found that trust in the bear management agency influenced perceptions of bear-related risks and benefits, and trust was higher among urban than rural residents (Cleary et al., 2021).

1.1 Study purpose and *a priori* model of acceptance

In this study we quantify relationships in a conceptual model of the socio-ecological system that determines individual variation in acceptance capacity for black bears among New York State property owners (Figure 1). Our aim was to test whether acceptance capacity for bears is influenced more by variables in the management environment (i.e., bear population density, level of human-bear interaction) or by the perceptions and traits of individual property

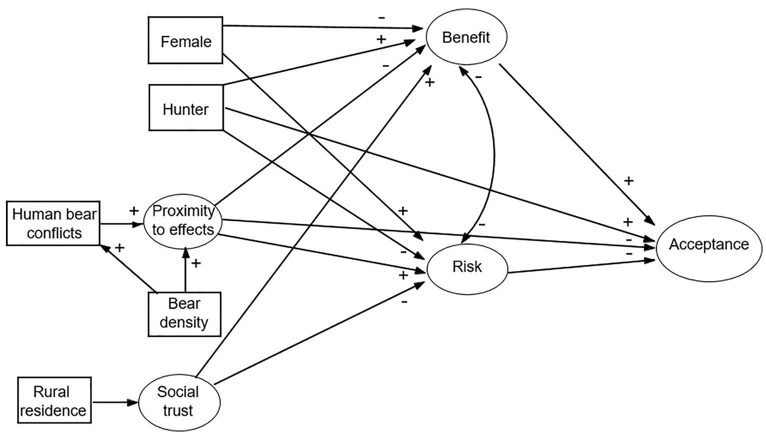

FIGURE 1
Our conceptual model of the ecological, social, and psychological variables that influence acceptance capacity for black bears (*Ursus americanus)* in New York State, USA. Straight lines represent hypothesized paths between variables. Curved lines represent hypothesized covariance between variables. Plus and minus signs indicate hypothesized direction of relationship between variables. Proximity to effects refers to perceived proximity to effects of human-bear interactions. Social trust refers to trust in the agency that manages black bears.

owners (e.g., risk perceptions, trust in wildlife managers). Human-bear interactions (e.g., seeing a bear, encountering a bear near one's home) can lead to an array of positive and negative psychological effects. Our central hypothesis was that the influence of bear population density on acceptance capacity is indirect and mediated by perceived distance from both positive and negative effects that result from human-bear interactions.

Proposed relationships between variables in Figure 1 represent our research hypotheses prior to model testing. Based on previously published information from the New York State Department of Environmental Conservation (NYSDEC, 2014), we expected bear density to be positively associated with the number of human-bear conflict reports per unit area. Previous analysis of a 2018 property owner survey in New York State found that the proportion of New York property owners who had seen (or heard about someone who had seen) a bear within 1 mile of their home was lowest in bear management zones with the lowest bear density and highest in zones with the highest bear density (Siemer et al., 2019). We thus assumed that residents of the study area would be aware of bear presence and ways that people in their area were affected by bears, so we hypothesized that both bear density and frequency of human-bear conflicts in the respondent's local area would influence their perceptions of proximity to human-bear interactions. Previous analysis of a 2018 property owner survey in New York State also revealed correlations between gender and involvement in hunting with bear-related risk, benefit, and acceptance capacity (Siemer et al., 2019), so we hypothesized that hunting and being male would be negatively associated with bear-related risk and positively associated with bear-related benefit perceptions. Based on previous research in Ohio (Zajac, 2010) we expected to find an inverse relationship between living in an area with few residents and trust in the bear management agency. Based on previous research on acceptance of natural and man-made hazards (Siegrist and Cvetkovich, 2000; Cleary et al., 2021) we expected social trust to influence bear-related benefit and risk perceptions, and we expected an inverse relationship between perceptions of bear-related benefits and risks. Based on research related to wildlife acceptance capacity (Decker and Purdy, 1988), we expected hunting and benefit and risk perceptions to directly affect acceptance.

1.2 Study area

Our study area was the upstate region of New York excluding the Adirondack Mountains in the northeastern part of the state (Figure 2); it encompassed both established and expanding bear ranges. Estimated bear density was >0 throughout the study area and ranged from 0.1 to >13 bears per 25 km^2 (Sun, 2019). The study area was entirely contained within the southern bear hunting zone (NYSDEC, 2014). All portions of the study area were open to bear hunting in 2018, except municipalities with restrictions on firearms discharge. Licensed hunters took 1,295 bears in New York in 2018; about 62% of the 2018 bear harvest occurred within the study area.

Much of the study area had low or moderate human population density (range 0.39 – 97 people km^2). The study area included three metropolitan areas within the state of New York (i.e., Syracuse, Albany-Troy-Schenectady, and Poughkeepsie-Newburg-Middletown). Portions of metropolitan areas had human population densities ranging from 193 – 965 people km^2 (Manson, 2020).

The study area fell within 6 of the 8 bear management zones (BMZs) within the state of New York designated by the state wildlife management agency (NYSDEC, 2014). The management objectives were to maintain moderate bear population density in two BMZs (i.e., Alleghany, Northern Catskill), maintain low bear population density in two zones (i.e., Southern Tier, Eastern Hudson), reduce bear population density in one zone (i.e., Southern Catskill), and keep bear occurrence infrequent in one zone (i.e., Lake Plain).

2 Methods

We combined data from three separate investigations to model factors that influence human acceptance capacity for black bears.

FIGURE 2
Study area where we tested a conceptual model of the ecological, social, and psychological variables that influence acceptance capacity for black bears (*Ursus americanus)* in New York State, USA. Dark line delineates the study area perimeter.

For information about psychological elements of the model, we used a subset of data from a 2018 statewide survey of New York State property owners. We incorporated human-bear conflict data from records of human-bear conflict reports received by NYSDEC from 2006 to 2018. Finally, we incorporated data on bear density estimates collected in 2017-2018. We describe each data collection process in the following sections.

2.1 Bear density estimates

Bear population densities across the southern hunting zone were estimated using spatial capture-recapture (SCR) models with data from 308 barbed wire hair snare sites (Sun, 2019; Sun et al., 2019). A total of 1,328 and 1,908 hair samples were collected in June-August of 2017 and 2018, respectively, to generate spatially-referenced encounter histories at the level of individual bears, which were then applied to SCR models using the oSCR package in program R (Sutherland et al., 2016). Models considered effects of landscape covariates on density including percentage of forest cover and landscape fragmentation. Spatially explicit bear densities were estimated at a 5 km x 5 km resolution to match the average scale of individual bear movement in New York State (Gardner et al., 2010; Sun et al., 2017), thus providing densities at an ecologically relevant spatial scale. Bear density was a mean of 1.8 bears/25 km^2 (95% CI: 1.2 – 2.9) averaged across models, resulting in a mean abundance estimate of 5,337 (95% CI: 3,421 – 8,418) bears in southern New York State (Figure 3). Density estimates using SCR approaches provide more accurate spatial information on bear density across southern New York State than was previously available to wildlife managers using harvest data.

2.2 Human-bear conflict records

Since 2005, staff in NYSDEC have recorded public reports of human-bear interactions using a standardized reporting form that classifies interactions from least severe (class 4) to most severe (class 1). Observations of normal bear behavior (e.g., foraging on natural foods) or a bear attracted to human foods (e.g., bear feeding at a garbage can) are coded as class 4 and class 3, respectively. Reports of a bear that demonstrates food conditioning, minimal fear of humans, or unresponsiveness to aversive conditioning, are coded class 2. Reports

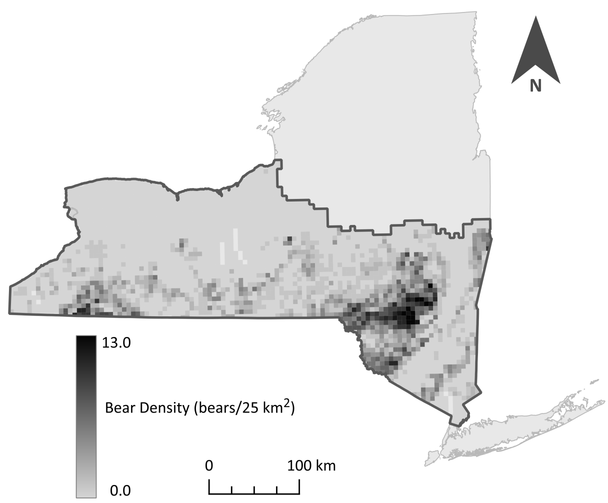

FIGURE 3
Information on density of black bears (*Ursus americanus)* per 25 square kilometers in New York State, USA in 2017 and 2018 (data from Sun, 2019 and Sun et al., 2019). Dark line delineates the study area perimeter. Darker shading indicates higher bear density.

of bear behavior that present a clear threat to humans, pets, or livestock (e.g., entering a home, attacking pets or livestock) are coded as class 1. Our analysis included data on the number and location of all 8,168 class 1–3 conflicts reported in our study area from 2006–2018 (class 4 reports were exluded because they represent observations of bear, not human-bear conflicts) (Figure 4).

2.3 Property owner survey

We developed a self-administered mailed questionnaire of property owners in 2018. The survey obtained data on: bear-related interests, concerns and experiences, perceived risks and benefits of having bears in New York State, perceived bear population trend, perceived proximity to effects of human-bear interactions, acceptance capacity for bears (Figure 5), trust in the agency that manages bears, and respondents' background characteristics (survey instrument provided in Supplemental Materials [document A]).

We drew a statewide random sample of 11,200 property owners for our survey. The sample was comprised of 1,400 property owners selected at random from each of the 8 BMZs. We drew subsamples of property owners in each BMZ from New York State tax rolls of residential property owners using zip codes that NYSDEC identified for each BMZ. We sampled property tax codes representing most types of residential property, including single and multi-family year-round residences, rural residences with acreage, agricultural properties that contained a primary residence, recreational use properties, estates, and mobile homes. To ensure that all members of the sample were residents of the BMZ being surveyed, we did not include owned property in the sample unless the address listed for the property owner was in the same zip code as the listed property. The sampling frame included urban and rural areas.

We incorporated traits of Dillman's Tailored-Design Method into our study, including a survey instrument with clear response instructions and simple and consistent response formats, explanation of why the study was important, personalized correspondence, multiple coordinated contacts with respondents, and trust-building elements (i.e., identifying the study sponsor, providing the investigator's contact information, assuring confidentiality) (Dillman et al., 2014). Survey mailings occurred between 10 October and 7 November, 2018. We contacted each member of the sample up to 4 times (i.e., an initial letter and questionnaire, a reminder postcard a week later, a second reminder letter and replacement questionnaire 2 weeks after the first reminder, and a final reminder 1 week after the third mailing). We contracted the Survey Research Institute (SRI) at Cornell University to complete follow-up telephone interviews with a sample of 25 nonrespondents in each BMZ; SRI completed a total of 200 nonrespondent interviews between December 6, 2018 and December 17, 2018. Interviews contained 17 key questions from the mail survey and took <5 minutes to complete (nonrespondent interview guide provided in supplemental materials [document B]). Our survey sampling protocol, survey instrument, and nonrespondent follow-up study was reviewed and granted approval by the Cornell University Office of Research Integrity and Assurance (Institutional Review Board for Human Participants Protocol ID#: 1004001374).

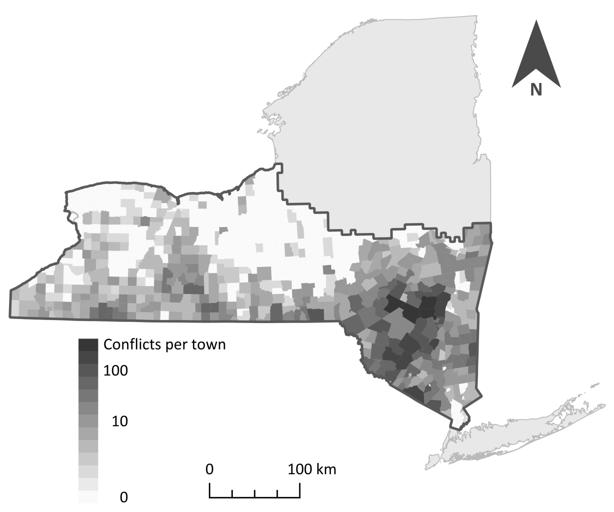

FIGURE 4
Number of reported human-black bear (*Ursus americanus)* conflicts by New York State (USA) township, 2006 – 2019. Data collected by the New York State Department Environmental Conservation. Dark line delineates the study area perimeter. Darker shading indicates higher density of conflict reports.

2.4 Model of acceptance capacity

We used as our starting point the psychological model of acceptance capacity developed by Zajac et al. (2012). The Zajac et al. (2012) model contained five latent variables that influence acceptance capacity for bears: similarity to bear managers on salient values (Siegrist et al., 2000), personal control, social trust, perceptions of bear-related benefits, and perceptions of bear-related risks. Our model of acceptance capacity incorporated most of the latent variables from Zajac et al. (2012) with additional variables related to perceived proximity to effects of human-bear interactions, mean density of bears, and human-bear conflicts. Our model also included three control variables (i.e., gender, participation in hunting, area of residence) (Figure 1).

We constructed a 4-item scale (Cronbach's α = 0.89) to measure acceptance capacity for bears, which was adapted from Zajac et al. (2012) (Table 1). The first 2 items asked for perceptions of the bear population at a statewide level and near where the respondent lived. These items had 5 response options, ranging from 1 (much too low) to 5 (much too high), with a midpoint (i.e., about the right size) coded as 3. The second pair of items assessed respondents' preferences for change in the bear population statewide and in the area where the respondent lived. These items had 5 response options, ranging from 1 (decrease greatly) to 5 (increase greatly), with a midpoint (i.e., stay about the same) coded as 3.

For measures of benefits, risks, and social trust, we adapted items and item coding from Zajac et al. (2012). We used 5 statements to create a measure of perceived bear-related benefits (Cronbach's α = 0.80) (Table 1). All items included 7 response options that ranged from -3 (strongly disagree) to +3 (strongly agree), with "0" for the response "Neither." One statement in this scale ("having bears in NYS is a nuisance") was reverse coded. We created a variable called benefits by averaging across all 5 items in the scale.

10.3389/fcosc.2023.1041393

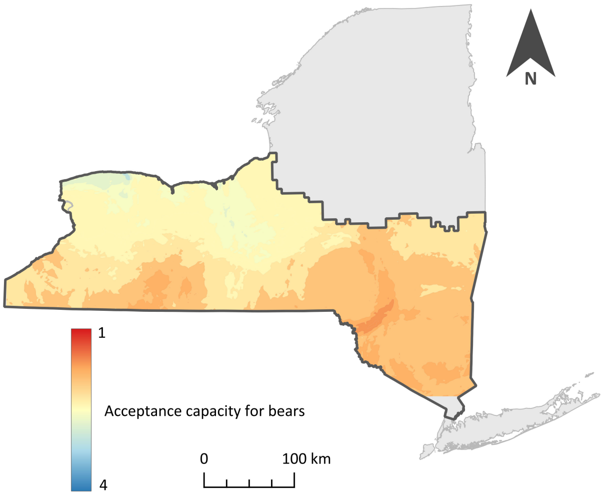

FIGURE 5
Acceptance capacity data, 2018 New York State Property owner survey (data from Siemer et al., 2019). Dark line delineates the study area perimeter. Data displayed as a moving average. All points within a given window are averaged for the location at the center of a circular window with 25 kilometer radius. Darker shading indicates lower acceptance capacity for black bears (*Ursus americanus*).

We used 6 statements to assess perceived bear-related risks (or costs), only three of which were retained in a latent variable we called Risk (Cronbach's α = 0.65) (Table 1). All items included 7 response options that ranged from -3 (strongly disagree) to +3 (strongly agree), with "0" for the response "Neither." We excluded two items because they loaded on a second factor (control over bear-related risks). One of the items ("I am not familiar with the risks posed by black bears") had a low risk factor loading and was dropped to improve scale reliability. We created the risk variable by averaging across all 3 items in the scale.

We used 4 statements to create an index of trust in the state agency that manages bears in New York (i.e., social trust) (α = 0.92) (Table 1). These statements identified respondent's confidence that the management agency can effectively manage bears, knows how to use appropriate management techniques, responds to human-bear conflicts appropriately, and listens to the public about bear-related concerns. We provided 7 response options that ranged from -3 (strongly disagree) to +3 (strongly agree), with "0" for the response "Neither." We created a variable called social trust by averaging across all four items in the scale.

We used 6 statements to create a scale measuring perceived proximity to effects of human-bear interactions (α = 0.83) (Table 1). These items draw on construal level theory, which posits that thoughts about an attitude object perceived as socially, geographically, or temporally distant will be viewed in abstract terms, while objects perceived as proximal will be viewed in concrete terms (Trope and Liberman, 2003; Trope and Liberman, 2010). We had 2 items each to measure perceived social, temporal, and geographic proximity to effects of human-bear interactions. All items included 7 response options that ranged from -3 (strongly disagree) to +3 (strongly agree), with "0" for the response "Neither." Some items were reverse coded, so that agreement indicated a perception of being proximal to, and disagreement indicated a perception of being distant from effects of bears.

We recorded respondents' gender with a single item (1=male, 2=female). A single item assessed participation in any type of hunting; we used that item to create a dummy variable called hunter (1=hunter, 0=not a hunter). We used one item to measure place of residence; we coded residence as 1 (town/city with many neighbors), 2 (outside town with scattered neighbors, or 3 (rural area with few neighbors).

We summed all class 1–3 conflict reports in each township from 2006–2018 to create a variable labeled total conflicts.

2.5 Analysis

We spatially matched datasets from three sources: a statewide survey of property owners in New York State (Siemer et al., 2019), human-bear conflict records in New York State, and local bear density estimates. All geospatial data processes and analyses were conducted in Manifold System Release 8 (Manifold Software Limited, Hong Kong). The surveyed property owners' physical addresses were matched to the physical addresses in the New York State Tax Parcel Centroid Points geospatial dataset, available through the New York State Geographic Information Systems Clearinghouse (NYS Office of Information Technology Services, 2021).

We determined local average bear density for each respondent using a rectangular moving window or neighborhood analysis of the bear density raster dataset. For each 25 km^2 focal cell in the bear density raster, the local average bear density was calculated as the average bear density for all raster cells within a 25 km by 25 km (625 km^2) square box centered on the focal cell. The local average bear density for each respondent was set to the value of the focal cell in which that respondent's property geolocation was located. The total number of conflict reports per township was associated with each surveyed property owner using a spatial overlay function using the conflict data from 2006 – 2018.

TABLE 1 Scale reliability and factor loadings of items to measure the latent variables acceptance, benefits, risks, personal control, proximity, and social trust.

Latent variable and measurement item text	Comparative fit index (CFI)	Factor loadings	Standard error
Acceptance (i.e., acceptance capacity for bears) (Cronbach's α = 0.89)			
Black bear populations in NYS are much too low, too low, about the right size, too high, much too high (Reverse coded)	1	0.78	0.012
Black bear populations near where I live are much too low, too low, about the right size, too high, much too high (Reverse coded)	1	0.66	0.015
I would prefer to see black bear populations in NYS decrease greatly, decrease slightly, stay about the same, increase slightly, increase greatly	1	0.90	0.006
I would prefer to see black bear populations near where I live decrease greatly, decrease slightly, stay about the same, increase slightly, increase greatly	1	0.92	0.007
Benefit (i.e., perception of bear-related benefits) (Cronbach's α = 0.80)			
The presence of black bears improves the quality of life in NYS.	1	0.83	0.013
Having black bears in NYS is a nuisance. (Reverse coded)	1	0.78	0.014
Black bears improve the ecosystem health of NYS.	1	0.68	0.015
Black bears provide wildlife viewing and hunting opportunities for many NYS residents.	1	0.39	0.022
The presence of black bears benefits the economy of NYS.	1	0.61	0.017
Risk (i.e., perception of bear-related risks) (Cronbach's α = 0.65)			
Encounters with black bears are likely to result in fatal consequences.	1	0.53	0.021
I am vulnerable to the risks posed by black bears.	1	0.62	0.019
Black bears will be more of a problem in NYS in the future.	1	0.71	0.017
I am not familiar with the risks posed by black bears.	Removed from analysis		
I can prevent conflict with black bears by taking precautions around my home. (Reverse coded)	Removed from analysis		
Conflict with black bears will be reduced as people learn to live with bears. (Reverse coded)	Removed from analysis		
Social trust (i.e., trust in bear management agency) (Cronbach's α = 0.92)			
DEC[2] can effectively manage black bears.	1	0.90	0.020
DEC[2] knows how to use appropriate black bear management techniques.	1	0.92	0.019
DEC[2] responds to human-bear conflicts appropriately.	1	0.76	0.019
DEC[2] listens to concerns about black bear management from the public.	1	0.78	0.019
Proximity (i.e., perceived distance from effects of human-bear interactions) (Cronbach's α = 0.83)			
Black bears have effects on people I know.	0.98	0.62	0.020
Black bears mostly affect people I don't know. (Reverse coded)	0.98	0.53	0.021
My local area is affected by black bears.	0.98	0.73	0.017
Black bears mostly affect areas that are far away from where I live. (Reverse coded)	0.98	0.66	0.018
I'm unlikely to be affected by black bears in the near future. (Reverse coded)	0.98	0.62	0.019
I'm unlikely ever to be affected by black bears. (Reverse coded)	0.98	0.67	0.017

[1]Our study area was the upstate region of New York excluding the Adirondack Mountains in the northeastern part of the state.
[2]New York State Department of Environmental Conservation.
Data are from respondents (n=1,772) to 2018 New York State property owner survey who resided within the study area[1], and responded to all items, considered in a model of acceptance capacity for black bears (*Ursus americanus).*

We used Statistical Package for Social Sciences (SPSS) (version 24) to analyze data from the 2018 property owner survey and to conduct confirmatory factor analysis of scales used to measure latent variables. We used the structural equation modeling (SEM) package in Stata (version 16.1) to estimate relationships between human-bear conflict, bear density, and variables in a psychological model of acceptance; we used maximum likelihood estimation for the analysis of covariance matrices in SEM. We assessed model fit with the Comparative Fit Index (CFI) and Root Mean Squared Error of Approximation (RMSEA). A CFI > 0.90 and a RMSEA < 0.08 are indicators of acceptable model fit; a CFI value > 0.95 and a RMSEA < 0.05 are indicators of close model fit (Hu and Bentler, 1999; Noer, 2003).

3 Results

3.1 Survey response rate

The adjusted sample size for the 2018 property owner survey was 10,028 (some of the 11,200 questionnaires we mailed were undeliverable due to an insufficient mailing address). We received 4,055 completed questionnaires from an adjusted sample size of 10,028 (40% response rate). Response rates varied by BMZ, ranging from a low of 33% in the Eastern Hudson zone to 47% in the Northern Catskill zone.

Respondents and nonrespondents were similar in their preference for size of the local bear population, but we found several differences between groups (respondent-nonrespondent comparison tables provided in supplemental materials [document C]). Nonrespondents were more likely than respondents to be female (45% vs. 35%; $x^2 = 7.91$, df = 1, p = 0.004), and less likely than respondents to: participate in hunting (21% vs. 34%; $x^2 = 13.26$, df = 1, p < 0.001), have seen a bear (71% vs. 78%; $x^2 = 6.09$, df = 1, p = 0.047), or believed they had a bird feeder or grill damaged by a bear (10% vs. 17%; $x^2 = 6.52$, df = 1, p = 0.010). Mean level of interest in bears was lower for nonrespondents (nonrespondents = 2.71, SD = 0.939 vs. respondents = 3.00, SD = 0.808 on a 4-point scale from no interest (1) to high interest (4); t = 4.75, df = 3,677, p < 0.001). Mean level of concern about bear-related property damage was lower for nonrespondents (nonrespondents = 1.64, SD = 0.996 vs. respondents = 1.89, SD = 0.973 on a 4-point scale from no concern (1) to high concern (4); t = 3.472, df = 3,472, p < 0,001). Nonrespondents also were more likely than respondents to reply “don’t know” when asked how the bear population in their local area had changed over the past 5 years (34% vs. 23%; $x^2 = 12.61$, df = 1, p < 0.001).

We explored whether respondent-nonrespondent differences could be addressed in part by weighting to adjust the male-female ratio. We found that weighting the data based on gender had no effect on bear population preference (a key component of acceptance capacity). The aggregated proportion of respondents who preferred their local bear population to decrease, stay about the same, or increase was no different when data from the nonrespondent follow-up study was used to weight the data by gender ($x^2 = 0.66$, df = 2, p = 0.72). Therefore, we decided not to weight the data based on gender for purposes of the analyses reported here.

We were able to utilize 44% of the data from the 2018 property owner survey for modeling purposes. Though we received 4,055 survey responses, we excluded respondents who resided outside the study area for the analyses we present here. Respondents who failed to answer questionnaire items used to create measured or latent variables in the SEM model were treated as missing cases. Using listwise deletion, 1,772 cases were used for the final analysis of the model.

3.2 Structural equation model

Indices of fit suggested that the conceptual model was an acceptable fit for the data (CFI=0.915; RMSEA=0.058), but modification indices identified multiple ways to improve model fit. We revised the structural model by adding covariance terms between two items within the latent variable proximity, two items within the latent variable acceptance, and between the variable hunting and an item within the latent variable benefit. Based on modification indices, we removed conceptual model paths from the variable gender to latent variables benefit and risk and we added two paths that were not specified in the conceptual model (i.e., paths from the variable area of residence to the latent variable proximity, and from the variable area of residence to the variable hunter). Indices of fit indicated that the revised model (Figure 6) was a better fit for the data (CFI=0.938; RMSEA=0.052). The final model explained 57% of the variance in acceptance.

The model results did not support our hypotheses that being male would have a direct negative effect on risk and a direct positive effect on benefit perceptions. Instead, gender had more effect on benefit and risk perception through influence on hunting involvement. Male respondents were much more likely than female respondents to participate in hunting. People who hunted perceived more benefits and fewer risks from bears, and thus were more accepting of bears.

Model results provided support for all hypothesized relationships between bear density, human-bear conflict, and proximity to effects of human-bear interactions. As hypothesized, there was a direct, positive relationship between bear density and total number of human-bear conflicts ($\beta = 0.51$). Increased bear density and number of human-bear conflicts contributed directly to perception that one was closer to the effects of human-bear interactions ($\beta = 0.21$ and $\beta = 0.23$, respectively). People who felt closer to effects of human-bear interactions perceived fewer benefits ($\beta = -0.10$) and higher risks ($\beta = 0.38$) of bears, which contributed to less acceptance of bears. People with more trust in the bear management agency perceived more benefits ($\beta = 0.40$) and less risk ($\beta = -0.26$) from bears. They also felt more distant from effects of human-bear interactions ($\beta = -0.18$) (Table 2).

Perceived proximity to effects of human-bear interactions, and perceived risks from bears, had direct, negative effects on acceptance ($\beta = -0.14$ and $\beta = -0.29$, respectively). Perceived benefits of bears had a direct, positive effect on acceptance ($\beta = 0.43$), and benefits had the largest standardized direct effect on acceptance in the final model. Social trust had the largest standardized indirect effect on acceptance in the final model ($\beta = 0.30$). Bear density had a smaller, indirect standardized effect on acceptance ($\beta = -0.09$), which was mediated by perceived proximity to effects of human-bear interactions (Table 2).

4 Discussion

Acceptance capacity for black bears is a complex interaction of several factors, including how many bears are in the landscape, how much residents trust the agency responsible for managing bears, perceptions of bear-related risks and benefits, and perceived proximity to effects of human-bear interactions. Our model

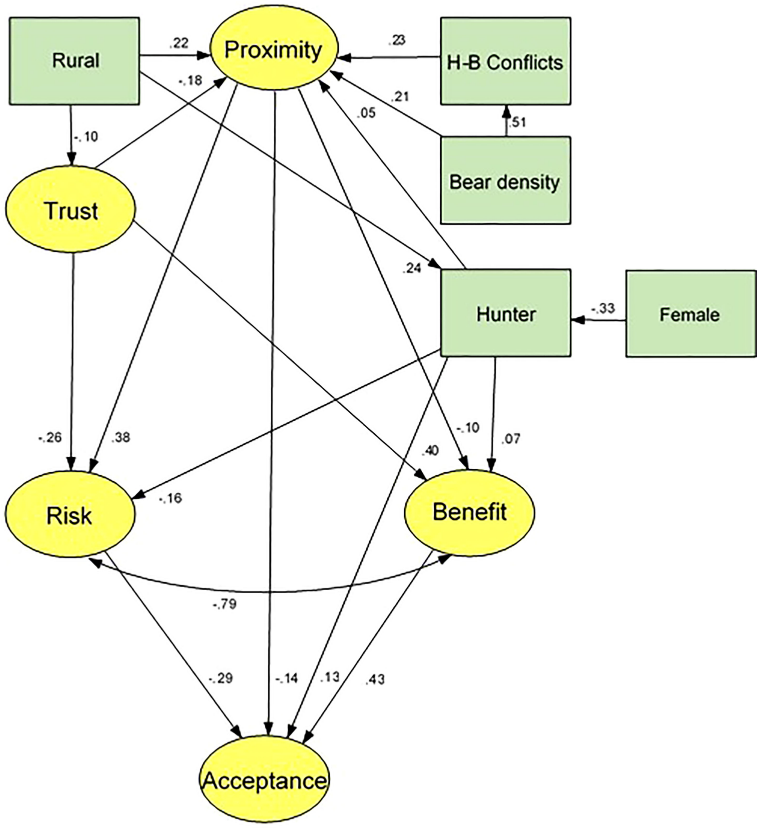

FIGURE 6
Standardized coefficients for best fit model of the ecological, social, and psychological variables that influence acceptance capacity for black bears (*Ursus americanus*). Rectangles represent measured variables. Ovals represent latent variables. Straight lines represent hypothesized paths between variables. Curved lines represent covariance between variables.

suggests that acceptance capacity for black bears increased when residents thought that they were distant from effects of human-bear interactions, that bear-related risks were low, and they perceived some benefits from having bears in the state. Trust in the bear management agency increased acceptance capacity indirectly by influencing bear-related perceptions. In contrast, as black bear density increased acceptance capacity was lower, because higher bear density translated into perceptions that one was more likely to be personally affected by bears.

As hypothesized, we found a strong relationship between social trust and perceptions of bear-related benefits and risks. Our finding that trust in the bear management agency increased perception of bear-related benefits was consistent with previous research in the context of bear management (Zajac et al., 2012; Cleary et al., 2021). Conversely, social trust also reduced perception of bear-related risk. That finding was consistent with previous research in the context of both bear management (Tredick, 2011; Zajac et al., 2012; Cleary et al., 2021) and management of chronic wasting disease in white-tailed deer (*Odocoileus virginianus*) (Vaske et al., 2004; Needham and Vaske, 2008; Vaske, 2010; Harper et al., 2015).

We anticipated a relationship between social trust and bear-related risk perception because risk management studies have shown a link between social trust and the public's perceptions of benefits and risks related to hazardous activities or technologies (Siegrist and Cvetkovich, 2000; Siegrist et al., 2000). Research in a range of contexts has found reduced threat appraisals associated with trust in the risk-management entity (Siegrist and Cvetkovich, 2000). When uncertainty about a risk is high and one's ability to make rational judgements based on personal knowledge is constrained, people rely on advice from trusted technical experts (Siegrist and Cvetkovich, 2000:714).

The management context in New York State in 2018 helps explain why the effect of social trust on risk perception was twice as strong in our study as the effect of social trust on risk perception among Ohio residents at a time when bears were recolonizing that state (Zajac et al., 2012). Zajac et al. (2012) attributed the weak effect of social trust on risk perception to survey respondents' lack of familiarity both with bears and the technical ability of the Ohio Division of Wildlife to manage bear-related risks (they reported that approximately 85% of respondents had no personal experience with bears). We attribute the strong relationship between social trust and risk perception among our respondents' to familiarity with bear behavior and bear management practices. In 2018, bears had been present and managed in New York State as a game species for over a century; 78% of our survey respondents had seen a wild black bear somewhere and 57% had seen, or knew of someone who had seen, a bear within a mile of the respondents' home. Perceptions of the technical competency of a management agency contribute to trust in that agency (Smith et al., 2013; Harper et al., 2015). Having some familiarity with the basic characteristics of bear management in

TABLE 2 Impact of exogenous and endogenous variables (rows) on one another (columns).

		Variable matrix								
	Effect[2]	Gender	Hunter	Rural	Proximity	Reported conflicts	Bear density	Trust	Benefit	Risk
Hunter	Direct	-0.33	—[3]	0.24	—	—	—	—	—	—
	Indirect	0	—	0	—	—	—	—	—	—
	Total	-0.33	—	0.24	—	—	—	—	—	—
Proximity	Direct	0	0.06	0.22	—	0.22	0.21	-0.18	—	—
	Indirect	-0.02	0	0.03	—	0	0.12	0	—	—
	Total	-0.02	0.06	0.25	—	0.22	0.33	-0.18	—	—
Reported	Direct	—	—	—	—	—	0.51	—	—	—
conflicts	Indirect	—	—	—	—	—	0	—	—	—
	Total	—	—	—	—	—	0.51	—	—	—
Social	Direct	—	—	-0.10	—	—	—	—	—	—
trust	Indirect	—	—	0	—	—	—	—	—	—
	Total	—	—	-0.10	—	—	—	—	—	—
Benefit	Direct	0	0.06	0	-0.10	0	0	0.40	—	—
	Indirect	-0.02	<-0.01	-0.05	0	-0.02	-0.03	0.02	—	—
	Total	-0.02	0.06	-0.05	-0.10	-0.02	-0.03	0.42	—	—
Risk	Direct	0	-0.14	0	0.33	0	0	-0.24	—	—
	Indirect	0.04	0.01	0.07	0	0.07	0.11	-0.06	—	—
	Total	0.04	-0.13	0.07	0.33	0.07	0.11	-0.30	—	—
Acceptance	Direct	0	0.13	0	-0.14	0	0	0	0.43	-0.29
	Indirect	-0.06	0.06	-0.05	-0.15	-0.06	-0.09	0.30	0	0
	Total	-0.06	0.19	-0.05	-0.29	-0.06	-0.09	0.30	0.43	-0.29

[1]Study area was the upstate region of New York State excluding the Adirondack region in northeastern New York.
[2]Direct effects (row 1), indirect effects (row 2), total effects (row 3) for each variable; all coefficients shown are standardized and significant at the 0.05 level.
[3]Dashed line indicate blank cells.
Data are from respondents (n=1,772) to 2018 New York State property owner survey who resided within the study area[1], and responded to all items, considered in a model of acceptance capacity for black bears (*Ursus americanus*).

New York State may have given many of our respondents greater trust in the ability of the wildlife agency to manage human-bear interactions, contributing to lower bear-related risk perceptions.

The strong inverse relationship we found between benefit and risk perceptions was expected and consistent with our conceptual model, given previous research on acceptance of wildlife-related hazards and other hazards (both natural and technological) (Siegrist and Cvetkovich, 2000; Siegrist et al., 2000). As Zajac et al. (2012) point out, the inverse relationship suggests that interventions through social programs to increase perceived benefits of bears could have the collateral effect of reducing perceived risks from bears. The significant effects of hunting on both risk and benefit perceptions illustrate this point. Respondents who participated in hunting were more likely to perceive bear-related benefits and less likely to perceive bear-related risks than were nonhunters. Because they perceived more bear-related benefits than bear-related costs, on average hunters had higher acceptance capacity for bears than did nonhunters.

Our finding that risk and benefit perceptions accounted for much of the explained variance in acceptance capacity was consistent with research on acceptance of bears in Ohio (Zajac et al., 2012) and tolerance for bears in eastern Oklahoma (Cleary et al., 2021). Benefit perceptions had a stronger effect on acceptance than risk perceptions. That result contrasts with results from the Ohio and Oklahoma studies, where risk perceptions had greater effect than benefit perceptions on the outcome variable (acceptance in Ohio, and tolerance in Oklahoma). The complete absence of bears in some parts of the Ohio and Oklahoma study areas may explain why perceived risks of bears were higher in those settings. Novelty and uncertainty are factors known to heighten risk perception (Slovic, 1987). The stronger role of benefit perceptions in our study may be due to the presence of bears across our entire study area. Benefits, including viewing opportunities, hunting opportunities, and existence value were more widely available to residents of our study area.

Construal level theory, which relates the degree to which an idea is thought of abstractly or concretely to its perceived proximity (or psychological distance) (Trope and Liberman, 2003; Trope and Liberman, 2010), provides a plausible explanation for increases in perceived risk and decreases in perceived benefits among people who believe they are in close proximity to effects of bears. Construal level theory would suggest that residents will form more concrete perceptions about bears as the potential effects of human-bear interactions become more socially, temporally, or geographically proximate. Indeed, increases in local bear population density raise the probability that residents will see a bear in their neighborhood or hear about someone in their area who has experienced a human-bear interaction. Seeing bears and hearing about human-bear conflicts nearby should make residents of an area feel less distant or separated from bear interactions.

Perceptions of bear abundance and proximity to their effects is likely influenced by exposure to interpersonal and mass communications. Previous research in New York State found that residents learn about local problem interactions with bears through exposure to interpersonal and mass communication, and television viewing had a direct effect on concern about bears (Siemer et al., 2007b; Siemer et al., 2009). Even though all survey respondents in our analysis lived within bear range, about 40% of respondents had never encountered a bear within a mile of their residence. Thus, interpersonal and mass communication about bear sightings and human-bear conflicts (and not personal experience) were likely the mechanisms by which some respondents formed their perceptions of local bear density and personal proximity to bear-related effects. Close encounters between people and bears in residential areas are often covered by local news media, and increasingly, awareness of wildlife and wildlife conservation issues is created through social media exchanges (Krakow, 2021; Bergman et al., 2022).

Of note, our estimate of bear density was more accurate than harvest-based calculations of bear density, but we did not consider uncertainty around bear density estimates. We cannot say how the influence of bear density on acceptance capacity might change if uncertainty around bear density estimates was considered. We were also limited in the number of concepts we could explore through a self-administered mail-back questionnaire. Previous studies found that value orientation, similarity of values with the wildlife management agency, and locus of control (self-efficacy) over bear-related problems were predictors of acceptance capacity for bears (Tredick, 2011; Zajac et al., 2012; Cleary et al., 2021). We excluded measures of those concepts to provide space in our survey instrument to explore hypotheses related to bear density and perceived proximity to effects of human-bear interactions.

It would be useful to include a measure of self-efficacy in future studies of acceptance capacity for bears. Having a sense of personal control over bear-related problems contributes to lower perceived risk from bears (Cleary et al., 2021). Future research could also explore the relationship between social trust and locus of responsibility for managing human-bear conflicts in residential areas. Most residential human-bear conflicts involve food attraction (Spencer et al., 2007; Lackey et al., 2018). Education materials produced by state wildlife agencies typically communicate that human-bear conflicts can be avoided by removing food attractants and that the responsibility for managing food attractants lies with individuals and communities (Spencer et al., 2007; Lackey et al., 2018). We hypothesize that differences in judgments of responsibility for managing human-bear conflicts (i.e., responsibility of property owners, wildlife agencies, or both) have an effect on social trust.

4.1 Management implications

Findings from this study have practical importance for state wildlife agencies that manage North American black bears in jurisdictions with relatively high bear and human populations. Collectively, our findings highlight that agency efforts to maintain public acceptance for bears require an integrated approach that combines actions to address bear-related perceptions and social trust along with active management of bear populations. Our findings on social trust suggest that agencies can influence acceptance capacity for bears in two ways: by maintaining social trust in areas where residents feel most distant from the effects of bears, and increasing social trust in areas where residents feel closest to the effects of bears. Communication efforts tailored to different contexts and audiences (e.g., urban areas with few bears, rural areas with high bear density, communities with persistent human-bear conflicts) could help wildlife managers address social trust. Agencies can deliver information that empowers citizens to reduce bear-related risks, or in more limited cases, directly intervene to reduce human-bear conflicts. Both actions can reduce perceived proximity to effects of human-bear interactions, which can in turn reduce perceived risk and increase social trust. Agency efforts to deliver education about the intrinsic, ecological, and utilitarian value of bears, as well as opportunities to enjoy and appreciate bears, can increase the proportion of citizens who benefit from bears.

Data availability statement

At the time of publication, data were not publicly available from the New York State Department of Environmental Conservation. Requests for access to the dataset analyzed for this study will be accommodated to the extent possible. Contact the corresponding author (wfs1@cornell.edu) for more information.

Ethics statement

The studies involving human participants were reviewed and approved by Cornell University Office of Research Integrity and Assurance (Institutional Review Board for Human Participants Protocol ID#: 1004001374). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

All authors contributed to writing; WS, TL, and RS collected social science data and led analysis; AF and CS collected bear density estimates; JB and KK provided spatial human-bear conflict data; NH integrated datasets and produced all figures. All authors contributed to the article and approved the submitted version.

Funding

This work was supported by New York Federal Aid in Wildlife Restoration Grant WE–173–G.

Acknowledgments

We express gratitude to the following staff at the New York State Department of Environmental Conservation for their assistance in 2017 spatial capture-recapture data collection and/or their contributions to our 2018 study of New York property owners,: L. Bifaro, J. Choquette, B. Dell, F. DiDonato, T. DiSpirito, C. Drasher, S. Heerkens, A. Kirsch, C. LaMere, M. Merchant, J. Milo, R. Rockefeller, and M. Schiavone. We extend our appreciation to property owners of New York State for their participation in this study. The quality of this manuscript was improved by the guidance of two reviewers and Associate Editor Igor Khorozyan. The property owner survey described in this report was organized and implemented by Cornell University and was not conducted on behalf of the U.S. Geological Survey. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcosc.2023.1041393/full#supplementary-material

References

Baruch-Mordo, S., Breck, S. W., Wilson, K. R., and Theobald, D. M. (2008). Spatiotemporal distribution of black bear-human conflicts in Colorado, USA. *J. Wildlife Manage.* 72 (8), 1853–1862. doi: 10.2193/2007-442

Beckmann, J. P., and Berger, J. (2003). Rapid ecological and behavioural changes in carnivores: the responses of black bears (Ursus americanus) to altered food. *J. Zool.* 261 (2), 207–212. doi: 10.1017/S0952836903004126

Bergman, J. N., Buxton, R. T., Lin, H.-Y., Lenda, M., Attinello, K., Hajdasz, A. C., et al. (2022). Evaluating the benefits and risks of social media for wildlife conservation. *FACETS* 7 (1), 360–397. doi: 10.1139/facets-2021-0112

Beston, J. A. (2011). Variation in life history and demography of the American black bear. *J. Wildlife Manage.* 75 (7), 1588–1596. doi: 10.1002/jwmg.195

Bruskotter, J. T., and Shelby, L. B. (2010). Human dimensions of large carnivore conservation and management: Introduction to the special issue. *Hum. Dimensions Wildlife* 15 (5), 311–314. doi: 10.1080/10871209.2010.508068

Cleary, M., Omkar Joshi, O., and Fairbanks, W. S. (2021). Mapping and modeling the components of human tolerance for black bears in eastern Oklahoma. *J. Environ. Manage.* 288, Article 112378. doi: 10.1016/j.jenvman.2021.112378

Decker, D. J., and Purdy, K. G. (1988). Toward a concept of wildlife acceptance capacity in wildlife management. *Wildlife Soc. Bull.* 16 (1), 53–57.

Dillman, D. A., Smyth, J. D., and Christian, L. M. (2014). *Internet, Phone, mail, and mixed-mode surveys: the tailored design* (Hoboken, New Jersey, USA: John Wiley & Sons).

Freedman, A. H., Portier, K. M., and Sunquist, M. E. (2003). Life history analysis for black bears (Ursus americanus) in a changing demographic landscape. *Ecol. Model.* 167 (1), 47–64. doi: 10.1016/S0304-3800(03)00171-6

Gardner, B., Royle, J. A., Wegan, M. T., Rainbolt, R. E., and Curtis, P. D. (2010). Estimating black bear density using DNA data from hair snares. *J. Wildlife Manage.* 74 (2), 318–325. doi: 10.2193/2009-101

Garshelis, D. L., and Noyce, K. V. (2008). "Seeing the world through the nose of a bear — diversity of foods fosters behavioral and demographic stability," in *Wildlife science. linking ecological theory and management applications*. Eds. T. E. Fullbright and D. G. Hewitt (New York, New York, USA: CRC Press), 139–163.

Harper, E. E., Miller, C. A., and Vaske, J. J. (2015). Hunter perceptions of risk, social trust, and management of chronic wasting disease in Illinois. *Hum. Dimensions Wildlife 20* 5), 394–407. doi: 10.1080/10871209.2015.1031357

Howe, E. J., Obbard, M. E., Black, R., and Wall, L. L. (2010). Do public complaints reflect trends in human-bear conflict? *Ursus* 21 (2), 131–142. doi: 10.2192/09GR013.1

Hristienko, H., and McDonald, J. E. (2007). Going into the 21st century: a perspective on trends and controversies in the management of the American black bear. *Ursus* 8 (1), 72–88. doi: 10.2192/1537-6176(2007)18[72:GITSCA]2.0.CO;2

Hu, L., and Bentler, P. M. (1999). Cutoff criteria for indicies in covariance structural analysis: conventional criteria versus new alternatives. *Struct. Equation Modeling* 6, 1–55. doi: 10.1080/10705519909540118

Krakow, M. (2021). Anchorage bear sightings flourish on social media, taking bear awareness to the next level. *Anchorage Daily News*. Available at: https://www.adn.com/alaska-news/wildlife/2021/07/11/anchorage-bear-sightings-flourish-on-social-media-taking-bear-awareness-to-the-next-level/.

Lackey, C. W., Breck, S. W., Wakeling, B., and White, B. (2018). *Human-black bear conflict: a review of the most common management practices*. Human-Wildlife Interactions Monograph 2:1-68. (Logan, Utah, USA: Jack H. Berryman Institute Press, Wildland Resources Department, Utah State University). Available at: https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1002&context=hwi_monographs.

Lischka, S. A., Riley, S. J., and Rudolph, B. A. (2008). Effects of impact perception on acceptance capacity for white-tailed deer. *J. Wildlife Manage.* 72 (2), 502–509. doi: 10.2193/2007-117

Lischka, S. A., Teel, T. L., Johnson, H. E., and Crooks, K. R. (2019). *Understanding and managing human tolerance for a large carnivore in a residential system* (238: Biological Conservation). doi: 10.1016/j.biocon.2019.07.034

Manson, S. M. (2020). *IPUMS national historical geographic information system: Version 15.0* (Minneapolis, Minnesota, USA: IPUMS). doi: 10.18128/D050.V15.0

Needham, M. D., and Vaske, J. J. (2008). Hunter perceptions of similarity and trust in wildlife agencies and personal risk associated with chronic wasting disease. *Soc. Natural Resour.* 21 (3), 197–214. doi: 10.1080/08941920701816336

New York State Department of Environmental Conservation (NYSDEC) (2014) *Black bear management plan for New York state 2014-2024*. Available at: http://www.dec.ny.gov/docs/wildlife_pdf/bearplan2014.pdf.

New York State Office of Information Technology Services, GIS Program Office (2021) *NYS statewide tax parcel centroid points [geodatabase file]*. Available at: http://gis.ny.gov/parcels/.

Noer, S. M. (2003). The role of structural equation modeling in scale development. *Struct. Equation Modeling* 10, 622–647. doi: 10.1207/S15328007SEM1004_8

Obbard, M. E., Howe, E. J., Wall, L. L., Allison, B., Black, R., Davis, P., et al. (2014). Relationships among food availability, harvest, and human-bear conflict at landscape scales in Ontario, Canada. *Ursus* 25 (2), 98–110. doi: 10.2192/URSUS-D-13-00018.1

Organ, J. F., and Ellingwood, M. R. (2000). Wildlife stakeholder acceptance capacity for black bears, beavers, and other beasts in the East. *Hum. Dimensions Wildlife* 5 (3), 63–75. doi: 10.1080/10871200009359188

Peyton, R. B., Bull, P., Reis, T., and Visser, L. (2001). *An assessment of the social carrying capacity of black bears in the lower peninsula of Michigan* (Department of Fisheries and Wildlife, East Lansing: Michigan State University).

Raithel, J. D., Reynolds-Hogland, M. J., Koons, D. N., Carr, P. C., and Aubry, L. M. (2017). Recreational harvest and incident-response management reduce human–carnivore conflicts in an anthropogenic landscape. *J. Appl. Ecol.* 54 (5), 552–1562. doi: 10.1111/1365-2664.12830

Siegrist, M., and Cvetkovich, G. T. (2000). Perception of hazards: The role of social trust and knowledge. *Risk Anal.* 20 (5), 713–719. doi: 10.1111/0272-4332.205064

Siegrist, M., Cvetkovich, G. T., and Roth, C. (2000). Salient value similarity, social trust, and risk/benefit perception. *Risk Anal.* 20 (3), 353–362. doi: 10.1111/0272-4332.203034

Siemer, W. F., Decker, D. J., Otto, P., and Gore, M. L. (2007a). *Working through black bear management issues: a practitioners' guide* (Ithaca, NY: Northeast Wildlife Damage Management Research and Outreach Cooperative). Available at: http://wildlifecontrol.info/wp-content/uploads/2016/04/bear-management-issues.pdf.

Siemer, W. F., Decker, D. J., and Shanahan, J. (2007b). Media frames for black bear management stories during issue emergence in New York. *Hum. Dimensions Wildlife* 12 (2), 1–12. doi: 10.1080/10871200701195415

Siemer, W. F., Hart, P. S., Decker, D. J., and Shanahan, J. (2009). Factors that influence concern about human-black bear interactions in residential settings. *Hum. Dimensions Wildlife* 14 (3), 185–197. doi: 10.1080/10871200902856138

Siemer, W. F., Lauber, T. B., Stedman, R. C., and Decker, D. J. (2019). *Understanding local residents' bear population preferences: Results from a survey in upstate New York. center for conservation social sciences publ. series 19-2* (Ithaca, NY: Dept. of Nat. Resources., Coll. Agric. and Life Sci., Cornell Univ.).

Slovic, P. (1987). Perception of risk. *Science* 236 (4799), 280–285. doi: 10.1126/science.3563507

Smith, J. W., Leahy, J. E., Anderson, D. H., and Davenport, M. A. (2013). Community/agency trust: A measurement instrument. *Soc. Natural Resour.* 26 (4), 472–477. doi: 10.1080/08941920.2012.742606

Spencer, R. D., Beausoleil, R. A., and Martorello, D. A. (2007). How agencies respond to human–black bear conflicts: A survey of wildlife agencies in north America. *Ursus* 18 (2), 217–229. doi: 10.2192/1537-6176(2007)18[217:HARTHB]2.0.CO;2

Sun, C. C. (2019). *Identifying landscape-wide spatial heterogeneity in population density and genetic structure of American black bear (Ursus americanus) in New York and the northeastern United States* (Ithaca, New York: Cornell University).

Sun, C. C., Fuller, A. K., Hare, M. P., and Hurst, J. E. (2017). Evaluating population expansion of black bears using spatial capture-recapture. *J. Wildlife Manage.* 81 (5), 814–823. doi: 10.1002/jwmg.21248

Sun, C. C., Royle, A. J., and Fuller, A. K. (2019). Incorporating citizen science data in spatially explicit integrated population models. *Ecology* 100 (9), e02777. doi: 10.1002/ecy.2777

Sutherland, C., Royle, J. A., and Linden., D. (2016). *oSCR: Multi-session sex structured spatial capture-recapture models*. R package version 0.30.0. Available at: https://github.com/jaroyle/oSCR.

Ternent, M. A. (2007). "Effect of lengthening black bear hunting seasons in northeast Pennsylvania on harvest rates of nuisance bears and population size," in *Proceedings of the 19th Eastern black bear workshop*. Eds. C. Ryan, H. Spiker and M. Ternent (Shepherdstown, West Virginia, USA: International Association for Bear Research and Management), 90–97.

Tredick, C. A. (2011). *Black bears in canyon de chelly national monument: Life in a changing environment (Doctoral dissertation)* (Blacksburg, Virginia, USA: Virginia Polytechnic Institute and State University).

Treves, A., Kapp, K. J., and MacFarland, D. M. (2010). American Black bear nuisance complaints and hunter take. *Ursus* 21 (1), 30–42. doi: 10.2192/09GR012.1

Trope, Y., and Liberman, N. (2003). Temporal construal. *psychol. Rev.* 110 (3), 403–421. doi: 10.1037/0033-295X.110.3.403

Trope, Y., and Liberman, N. (2010). Construal-level theory of psychological distance. *psychol. Rev.* 117 (2), 440–463. doi: 10.1037/a0018963

Vaske, J. J. (2010). Lessons learned from human dimensions of chronic wasting disease research. *Hum. Dimensions Wildlife* 15 (3), 165–179. doi: 10.1080/10871201003775052

Vaske, J. J., Timmons, N. R., Beaman, J., and Petchenik, J. (2004). Chronic wasting disease in Wisconsin: Hunter behavior, perceived risk, and agency trust. *Hum. Dimensions Wildlife* 9 (3), 193–209. doi: 10.1080/10871200490479981

Witmer, G. W., and Whittaker, D. G. (2001). "Dealing with nuisance and depredating black bears," in *Proceedings of the Western black bear workshop*, vol. 7 . Eds. E. C. Meslow, J. A. Mortenson, D. H. Jackson and D. G. Whittaker (Boise, Idaho, USA: Western Association of Fish and Wildlife Agencies), 73–81.

Wooding, J. B., Cox, J. A., and Pelton, M. R. (1994). "Distribution of black bears in the southeastern coastal plain," in *Proceedings of the annual conference of southeastern association of fish and wildlife agencies*, vol. 48. , 270–275.

Zack, C. S., Milne, B. T., and Dunn, W. C. (2003). Southern oscillation index as an indicator of encounters between humans and black bears in new Mexico. *Wildlife Soc. Bull.* 31 (2), 517–520.

Zajac, R. M. (2010). *Psychological and geographic components of acceptance for black bears in Ohio. (Master's thesis)* (Columbus, Ohio, USA: Ohio State University).

Zajac, R. M., Bruskotter, J. T., Robyn, S., and Prange, S. (2012). Learning to live with black bears: A psychological model of acceptance. *J. Wildlife Manage.* 76 (7), 1331–1340. doi: 10.1002/jwmg.398