

The price of tolerance: wolf damage payments after recovery

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Abstract The costs of wildlife conservation distribute unequally across society. Compensation can potentially redress inequities and raise local tolerance for endangered wildlife that damage property. However, the rules for payments generate controversy, particularly as costs mount and species recover. In Wisconsin (USA), gray wolf damage payments grew notably over 28 years and eventually undermined budgets for conserving other endangered species. We measured attitudes to compensation among 1,364 state residents, including those who voluntarily contributed funds and those likely to receive compensation, and we interviewed elected officials about the politics of payment rules. Most respondents endorsed compensation for wolf damages to livestock—even when wolves are no longer endangered—but opposed payments for wolf damage to hunting dogs on public land. Most donors opposed killing wolves and over one-fourth unconditionally rejected a wolf hunt. We predict the latter donors would stop contributing funds for compensation if the state were to implement a proposed wolf hunt. Controversy over payment rules reveals clashing values regarding wildlife between those receiving and those

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paying for compensation. Moreover, the costs of compensation ratchet up as endangered species recover and claims of entitlement expand. Hence we recommend conservationists use sunset clauses and an adaptive management of compensation programs.

Keywords Manage · Compensation · Programs · Adaptively

Introduction

Compensation for wildlife damage and financial incentives for wildlife conservation are part of many threatened and endangered species' recovery programs across the world (Montag 2003; Nyhus et al. 2003; Schwerdtner and Gruber 2007; Zabel and Holm-Muller 2008). Such payments are particularly prevalent in large carnivore restoration programs to offset costs of lost livestock and other property [e.g., >6.4 million USD equivalents paid in compensation from 1990 to 1995 in Europe: Breitenmoser and Angst 2001 #91]. Compensation payments promise to reduce the economic motivation for property owners to kill wildlife illegally (Naughton-Treves et al. 2003; Zabel and Holm-Muller 2008), and may prove more cost-effective than direct enforcement of wildlife protection (Stroup 1997). In the words of a grizzly bear (*Ursus arctos*) manager, compensation "throws some water on the fire" (M. Bruscano, Wyoming Fish & Game, personnel communication). Raising peoples' tolerance for carnivores during the vulnerable early stages of restoration could, therefore, accelerate population recovery (Thompson 1993; Montag 2003; Nyhus et al. 2003; Zabel and Holm-Muller 2008).

The merits of continuing to pay compensation *after* threatened species recover are less clear. For one, reducing illegal killing of wild animals may be less vital as state agencies themselves turn to public hunting, culling and selective removal. Indeed, some legal analysts argue that citizens who regain the right to kill wolves to defend their livestock no longer require compensation (Thompson 1997). Also some worry about the high costs of verification and administration of payments and associated corruption, fraud and waste (Montag 2003; Montag et al. 2003; Nyhus et al. 2003; Schwerdtner and Gruber 2007). Can wildlife managers afford to verify and pay for damage by recovered species as other imperiled species languish? Finally prolonged compensation programs may create a sense of entitlement and generate moral hazards (Bulte and Rondeau 2005; Schwerdtner and Gruber 2007). For example, will farmers invest in predator-proof fences if they know they will always be compensated? These questions integrate legal, budgetary, attitudinal, and conservation concerns. Compensation is a political issue that places competing views of the needs of wildlife and people in sharp contrast. The case of the gray wolf (*Canis lupus*) in the coterminous United States is revealing.

After three decades of strict federal protection, on 4 May 2009, the US Fish and Wildlife Service (USFWS) removed gray wolves in the western Great Lakes region and parts of the Northern Rocky Mountains from the federal list of endangered species (USFWS 2009). Hence five states and associated tribal authorities are deliberating on how to manage wolves. Federal "delisting" marks a historic success for US wildlife conservation and shifts the emphasis from recovery to coexistence (Wydeven et al. 2009). In parallel, wolf damage compensation programs are being reconsidered.

Thus far, the US federal government itself has not paid compensation for wolves (Fritts et al. 1992; Bangs et al. 1998; Mech 1998; Phillips and Smith 1998; Treves et al. 2002). Indeed there is no US law or constitutional requirement that the federal government compensate owners for property lost to endangered wildlife (Thompson 1997). Thompson

(1997) and Doremus (1999) examined government liability for wildlife by reviewing numerous lawsuits over alleged ‘takings’ by wolves and other protected species. They found courts typically ruled against plaintiffs’ demand for compensation because (a) wild animals—not the government—chose where they went and what they did; (b) invasion by wildlife was typically temporary and shifting and thus did not constitute ‘taking’; and (c) wildlife reintroduction raised the costs of doing business but did not preclude any particular use. But Thompson (1997) criticized US courts for failing to redress wildlife regulations that disproportionately burden individual citizens.

Despite legal precedents against government compensation (in the USA at least) and other broader criticisms of compensation (Montag 2003; Bulte and Rondeau 2005; Schwerdtner and Gruber 2007), many policy-makers still view it as politically pragmatic in species recovery programs (Blume and Rubinfeld 1984; Brown 1995; Wilson 1999; Nie 2003). Doremus (1999) conceded this point but argued compensation should be paid from voluntary contributions, not government funds. Yet private funding raises the risk donors will have inordinate control over the terms of payment and, by extension, will limit individual freedom to respond to wildlife threats. Thus, at many carnivore recovery sites today the debate is not about whether to compensate, but rather how to design financially sustainable and fair payments. Specifically, who should pay, who should receive, and what form should payment take as a species recovers?

Here we report payment policies and public attitudes toward compensation in the wake of wolf recovery in Wisconsin (WI), USA. WI wolf policy is illuminating due to its long, well-documented experience with compensation (Wilson 1999; Treves et al. 2002) including repeated efforts to modify policy as wolves recovered and were reclassified (Treves 2008; Refsnider 2009). We compared the attitudes of individual contributors to the state’s voluntary compensation fund with those of non-contributors. We focus particular attention on attitudes toward payment rules and associated wolf control methods. We compare preferred rules for payment from our public survey to the formally negotiated legislation. To understand why policies might be at odds with prevailing public attitudes, we interviewed state politicians with oversight of natural resource legislation. We did not examine administrative issues relating to corruption, inefficiency, or distribution of payments relative to risk and losses (Montag 2003; Bulte and Rondeau 2005; Schwerdtner and Gruber 2007; Zabel and Holm-Muller 2008) because our focus was on political dimensions of compensation during and after the recovery of an endangered species.

History of wolf compensation in Wisconsin

WI began compensating citizens for livestock losses to wolves in 1982, shortly after wolves were listed as an endangered species (Treves et al. 2002). WI’s winter count of wolves rose from zero to ~600 in a span of 30 years (Wydeven et al. 2009; AP. Wydeven, unpublished data). As a result, wolf damage compensation became more costly and more politically charged as wolves threatened other domestic animals and moved into more densely settled areas (Fig. 1). From 1982 to 2008 wolves accounted for 79% of damage claims and 89% of payments recorded by the WI Department of Natural Resources’ (WDNR) Endangered Resources (ER) fund, which pays for state threatened and endangered species damages. Specifically the ER fund paid for the following wolf damages (R. Jurewicz, WDNR ER Bureau files): (a) 629 livestock injured or killed on private lands, amounting to 43% of compensated damages; (b) 115 hunting dogs injured or killed on public lands and 12 pet dogs injured or killed on private lands, amounting to 39% of

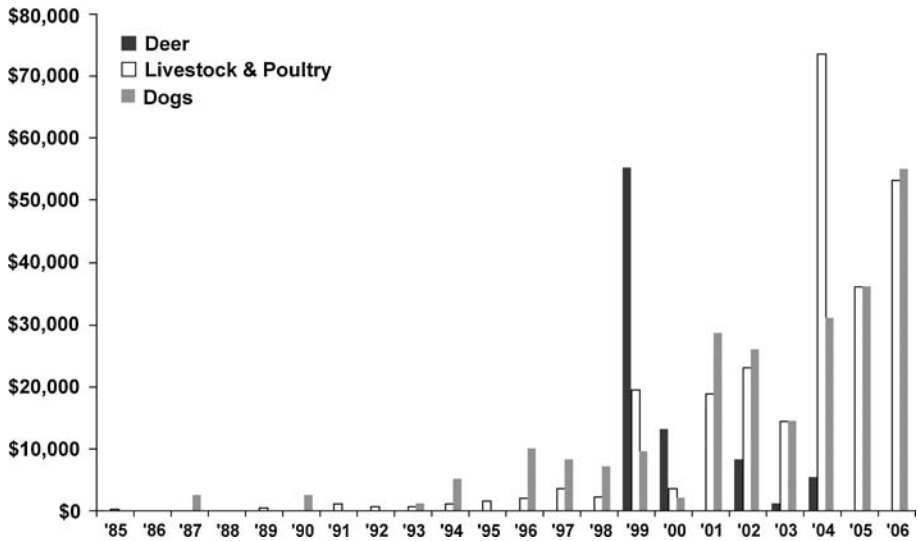


Fig. 1 Compensation payments for three types of domestic or farm animals injured or killed in verified wolf attacks in WI from 1985 to 2006. Deer (*Odocoileus virginianus*) were farmed in forested enclosures

compensated damages; and (c) 44 farmed white-tailed deer (*Odocoileus virginianus*) killed, amounting to 18% of compensated damages.

Until recently all compensation payments required field verification of wolf involvement by the US Department of Agriculture Wildlife Services (USDA-WS) (Treves et al. 2002). This requirement frustrated some livestock producers who believed it was difficult to prove wolf culpability (Naughton-Treves et al. 2003). As wolf numbers increased, it also became far more costly to verify every incident. In 2001 the WDNR compensated a livestock producer for missing calves based on prior verified losses without direct evidence of wolf predation (Treves 2008). In 2007, this step was formalized and extended to all livestock producers with previously verified losses (WDNR 2007a, b).

Since 2002 wolf compensation payments have exceeded USD 100,000 per year (Fig. 1). Compensation for hunting dogs hurt or killed by wolves on public land is less common but more costly than livestock losses per capita [Treves et al. 2002 #556]. There was no cap on the amount paid to an individual claimant; however, payments for individual animals were limited. For livestock, payment amounts were set by the projected fall market price (e.g., USD 602 per calf in 2004) no matter when the animal was killed. Payment for each hunting dog was limited to USD 2,500, whereas each farmed deer was priced as either a trophy animal (USD 4,000–5,000) or meat (USD 200), depending on the deer and the enterprise. Veterinary bills were paid for injured animals of all sorts, in addition to replacement cost if the injured animal subsequently died (Treves et al. 2002).

WI compensation monies derived from (1) annual state income tax forms with a voluntary check-off (CHECK OFF); (2) a surcharge on specialty license plates that depict a wolf; (PLATE) and (3) matching funds from state general-purpose revenues. Because the ER fund covers all threatened and endangered species, contributors are unlikely to know how much of their support goes to wolf compensation. Since 2001 the state earned an annual average of USD 590,000 from PLATE sales (Joint Committee on Finance 2005), and 608,000 from CHECK OFF contributions. Adding a revenue match of ~USD 400,000

annually from the state's general purpose revenues, total ER fund revenues averaged USD 1.6 million per annum since 2001 (Joint Committee on Finance 2005). Wolf damage payments alone currently consume ~10% of the ER budget rather than the 3% expected when the program began. The rising cost of wolf compensation payments required managers to cut budgets for protecting habitat and restoring trumpeter swans (*Cygnus buccinator*), whooping cranes (*Grus americana*), and other endangered species (R. Jurewicz, unpublished).

Plans for delisting wolves from the state endangered species list began in WI in 1999 (prior to federal delisting). Some parties feared compensation would stop with delisting. Led by a state senator from a district within wolf range, interest groups lobbied successfully for statutory language to extend compensation for wolf damage in perpetuity:

“For purposes of [...] payments of claims for damages associated with endangered or threatened species, the gray wolf shall be considered an endangered or threatened species regardless of whether it is listed [as such]....” (1999–2001 WI state budget bill s. 71.10 (5)(am), Statutes).

In 2003, responding to this new mandate the WDNR proposed stricter compensation rules to rein in escalating costs including: (1) a USD 250 deductible per claim; (2) a USD 15,000 cap per claimant per year; (3) stipulating best management practices before payment; (4) a “5-mile rule” restricting payments for dogs hurt by wolves on public land to only once per year at a given site (subsequent losses within 8 km of that site would not be compensated, and warning signs would be posted around the area); (5) a “sunset” clause ending ER fund payments if wolves were reclassified as game; and (6) making payments for missing livestock generally applicable after a verified depredation. Decisions about these rule revisions were made in 2005 (see “Results”). Amid state and national debates on wolf classification and compensation, we sent out our survey in late 2004.

Methods

Our survey instrument incorporated insights from years of discussion with WI citizens about wolves and compensation, including 42 field interviews with livestock producers in 2000 about vulnerability to wolf damage (Treves et al. 2004), and stakeholder statements at public meetings. R. Jurewicz administered compensation payments and read all related correspondence from landowners, elected officials, and other interested parties from 1982 to the present. The above discussions and one previous study (Wilson 1999) helped us identify key issues surrounding wolf recovery and compensation. Our goal of sampling many residents' opinions made focus groups, telephone interviews, and face-to-face interviews impractical. Instead we opted for a self-administered, mail-back questionnaire to reveal respondents' attitudes toward compensation and the merits of future compensation scenarios.

Questionnaires

We designed a survey of public opinion, tested the instrument with colleagues and ~200 students at the University of Wisconsin-Madison, and repeated several questions previously developed for WI and the Northern Rocky Mountains region (Montag et al. 2003; Naughton-Treves et al. 2003). Copies of the questionnaire are available from the authors. We designed our questionnaire to conform with expert recommendations on survey length,

Table 1 Wisconsin zip codes in our survey sample and characteristics of our respondents

Zip code characteristics				Respondent characteristics ^e			
Name	Donors % ^{a,b}	Rural/urban ^c	Wolves? ^d	<i>N</i>	Donated %	Income %	Education %
Butternut 54514	1.24 (<0.01)	Rural	Yes	240	10	17	29
Owen 54460	2.11 (0.02)	Rural	Yes	194	8	9	16
Wausau 54401	2.91 (0.61)	Urban	Yes	188	15	28	35
Fond du Lac 54935	2.91 (<0.01)	Urban	No	175	23	27	33
Sister Bay 54234	1.46 (<0.01)	Rural	No	177	20	32	59
Madison 53705	3.64 (2.89)	Urban	No	199	43	40	79

^a % of license plates purchased with a wolf logo in 2003; the average for all zip codes was 2.23%

^b The numbers in parentheses refer to % of tax returns with a donation to the ER Fund; the state average per zip code was 0.13%

^c Following US Census Bureau 2000 Data

^d Following WDNR delineation of the breeding wolf population range in 2004

^e Self-reported donations to the ER Fund, household income >75,000 USD, college degree or more (See “Methods”)

salience, and question order (Dillman 2007). For example, we included only one forced-choice question (yes/no responses, reviewed in Smyth et al. 2006) about respondents joining an incentive program. As predicted, this question seemed to generate acquiescence bias (unusually high agreement) when compared to a similar question that allowed a graded response, including neutral. Thus, we discarded the former from analysis.

Because we were interested in comparing attitudes of contributors to the ER Fund with those of non-contributors, we purchased state records of contributions in 2003 summarized by zip code (i.e., individual identities were censored and unavailable). Of the 4,053,257 WI license plates purchased or renewed in 2003, 90,406 (2.2%) had the wolf logo (PLATE). Also, 39,365 state income tax returns in 2003 included CHECK-OFFs totaling USD 634,227. CONTRIBUTORS in our sample reported owning a PLATE at any time, or making a CHECK-OFF contribution in the previous 5 years. Our population of interest was adults and the sampling frame included those with listed addresses in six WI postal (zip) codes. We selected the six zip codes to include residents in three rural and three urban areas, three within and three beyond wolf population range, and spanning high to low levels of donation to the ER fund (Table 1).

We sent our questionnaire to 2,400 state residents (400 per zip code) randomly selected from commercial lists of telephone numbers and addresses (Survey Sampling International LLC, Fairfield, CT). We included a USD 2 incentive with the 7-page survey, a cover letter guaranteeing confidentiality, and a reminder postcard after 3 weeks (following recommendations in James and Bolstein 1992). We lacked resources to assess non-response bias directly. However, non-respondents to wildlife management surveys tend to be less interested in the issues covered by the survey (e.g., Decker et al. 2006), so we expect our non-response bias under-represents neutral positions. Further support for this assumption comes from the large number of questionnaires returned with extensive marginal comments written in by hand, from both pro- and anti-wolf respondents (unpublished data).

We ran statistical tests in JMP 8.0.1 (SAS Institute 2009). Because the same respondents were being analyzed for an article on hunting (A. Treves and K.A. Martin, unpublished data), we used a Bonferroni corrected significance criterion of $P < 0.025$ throughout. Sample sizes for tests varied because not all respondents answered all questions. For tests comparing

CONTRIBUTORS to NON-CONTRIBUTORS we used (a) Fisher's exact P value for a categorical variable with two levels; (b) Pearson's contingency test using X^2 for a categorical variable with three or more levels; and (c) Student's t -test assuming unequal variances for a continuous variable. We report the df only once for any given variable. For brevity and clarity we treat "Strongly Agree" and "Agree" responses as "agree" and "Strongly Disagree" and "Disagree" as "disagree" but Pearson contingency tests used the 5-level Likert scale with $df = 4$.

We categorized INCOME as <40,000 USD, >75,000 USD, or in between; and EDUCATION as having a bachelor's degree or not (Table 1). Sample sizes were lower for INCOME (-12.5%) and EDUCATION (-14%), possibly because respondents withheld this information for privacy. HUNTERS were those who reported "hunting any wildlife within the past 2 years" or "regularly hunting at any time in the past". LIVESTOCK PRODUCERS were those who responded "Yes" to any of the following questions: "During the past 5 years, have you raised any livestock for commercial purposes?" or "Have you raised livestock at any other time in your life?" or "Has raising livestock ever been a major source of income for you?"

Interviews and public hearings

In 2005 the WDNR held five public hearings across the state and invited written comments on their 2003 proposals to reduce compensation (Clearinghouse Rules 05-004 and 05-005). We report the outcomes of public hearings and politicians' deliberations on the proposed rule revisions. For the latter, we interviewed seven of the 19 representatives serving on two State committees with administrative oversight for natural resource legislation. In each interview we shared unpublished results of our public survey with them (this study) and then asked about committee decisions in light of public opinion. We report key excerpts anonymously, as they requested.

Results

Of 2,400 surveys we mailed, 198 were undeliverable because recipients were deceased, infirm, or had moved to locations unknown. We discount these from our total mailed so the 1,364 surveys received represent a response rate of 61.9%. We had no surveys returned with no data. Among our 1,364 respondents, 212 reported donating via CHECK-OFF, 40 via PLATE, and 22 via both; so we had 230 CONTRIBUTORS (16.9%) in our sample. Among 685 HUNTERS and 423 LIVESTOCK PRODUCERS, we found similar proportions of CONTRIBUTORS: 126 (18.4%) and 62 (14.7%), respectively.

Overall 72.7% of respondents were men and 27.3% women, reflecting a common bias of mailing lists based on telephone records (Decker et al. 2006; Dillman 2007). Men predominated in all six zip codes sampled. This sex bias should not affect our interpretation of results about CONTRIBUTORS and NON-CONTRIBUTORS ($n = 932$) because it was equivalent for the two groups ($P = 0.50$). CONTRIBUTORS and NON-CONTRIBUTORS were of similar average age ($t = -0.90$, $df = 372$, $P = 0.37$) and were equally likely to be HUNTERS (54.8 vs. 59.0%, $P = 0.26$).

However, CONTRIBUTORS were less likely to be LIVESTOCK PRODUCERS than were NON-CONTRIBUTORS (27.0 vs. 38.1%, $P = 0.0016$). When we removed the urban zip codes (Table 1), that trend was no longer significant ($P = 0.061$). Also more of the CONTRIBUTORS had graduated college (63.6 vs. 37.4%; $P < 0.0001$) and averaged

higher INCOME ($X^2 = 16$, $df = 2$, $P = 0.0004$). Proportion of CONTRIBUTORS varied by zip code ($X^2 = 105$, $df = 5$, $P < 0.0001$, Table 1). Because zip codes also averaged different INCOME ($X^2 = 83$, $df = 10$, $P < 0.0001$) we assessed whether CONTRIBUTORS had higher INCOME than NON-CONTRIBUTORS *within* their zip codes. Only Wausau's CONTRIBUTORS had higher INCOME ($X^2 = 10$, $df = 2$, $P = 0.007$) whereas the other five zip codes showed no differences ($X^2 < 4.5$, $P > 0.10$ in all cases).

CONTRIBUTORS were more tolerant of wolves judging from responses to the question: "In your opinion, the wolf population in Wisconsin should be kept below...". Given the choice of "250", "350", "500", "1,000" or "No cap", 35% of CONTRIBUTORS chose "No cap" and 25% chose "1,000" versus 21 and 12% of NON-CONTRIBUTORS, respectively ($X^2 = 88$, $P < 0.001$).

Compensation as a strategy

CONTRIBUTORS and NON-CONTRIBUTORS valued compensation differently. A majority (59%) of CONTRIBUTORS agreed that "Compensation programs spread costs related to wolf conservation more fairly within society"—compared to 37% of NON-CONTRIBUTORS ($X^2 = 33$, $P = 0.0011$). Majorities of both the CONTRIBUTORS and NON-CONTRIBUTORS disagreed with the statement that "Losses/damages caused by wolves are a part of raising livestock and should not be compensated" (although NON-CONTRIBUTORS were more likely to agree: Table 2). A greater proportion of CONTRIBUTORS than of NON-CONTRIBUTORS disagreed with the statement that "Compensation programs are publicity stunts that do not address the real issues"—55% disagree vs. 33% agree ($X^2 = 63$, $P < 0.0001$). For all three questions, CONTRIBUTORS who were also LIVESTOCK PRODUCERS responded similarly to other CONTRIBUTORS ($X^2 < 3$, $P = 0.75$ in all cases).

CONTRIBUTORS and NON-CONTRIBUTORS agreed on some statements. A majority in both groups agreed that, "Even when wolves are no longer threatened or endangered, compensation programs should continue" (Table 2). A majority of CONTRIBUTORS and a plurality (the most often chosen response) of NON-CONTRIBUTORS

Table 2 Responses to hypothetical scenarios for wolf compensation in Wisconsin

Statement from questionnaire	CONTRIBUTORS	NON-CONTRIBUTORS	Pearson contingency test
Losses/damages caused by wolves are a part of raising livestock and should not be compensated	Agree = 12% Neutral = 27% Disagree = 61%	Agree = 20% Neutral = 18% Disagree = 62%	38*
Even when wolves are no longer threatened or endangered, compensation programs should continue	Agree = 55% Neutral = 19% Disagree = 26%	Agree = 52% Neutral = 20% Disagree = 28%	NS
My tolerance for wolves would decrease if compensation programs were no longer available	Agree = 16% Neutral = 29% Disagree = 55%	Agree = 28% Neutral = 33% Disagree = 39%	24*
I am worried that as wolf populations become well established, it will be too expensive to continue to fund compensation programs	Agree = 40% Neutral = 29% Disagree = 31%	Agree = 56% Neutral = 25% Disagree = 19%	36*

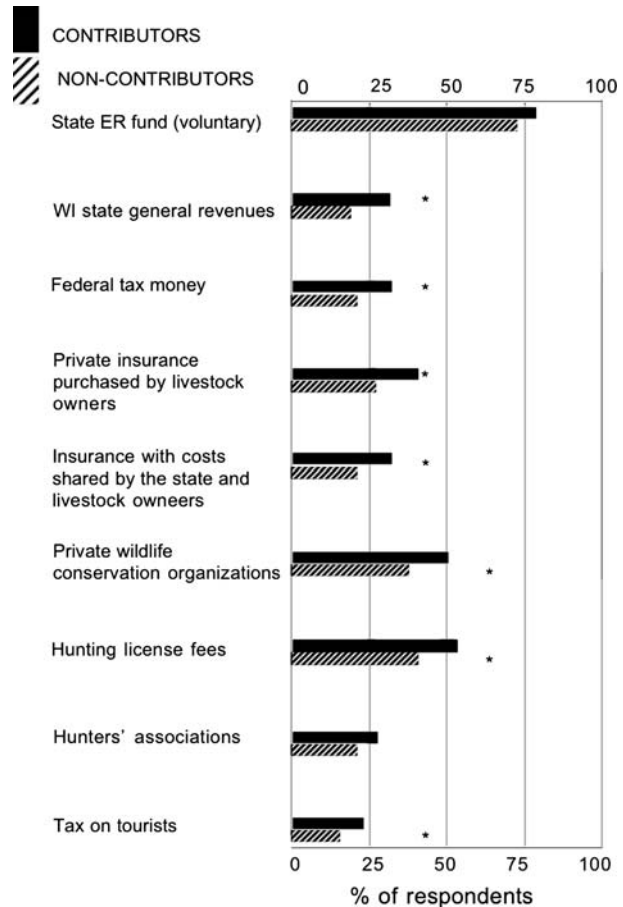
Comparing CONTRIBUTORS to NON-CONTRIBUTORS, * $P < 0.001$

disagreed with the statement that “My tolerance for wolves would decrease if compensation programs were no longer available”. Both groups viewed rising costs of compensation in the same light (Table 2). CONTRIBUTORS who were LIVESTOCK PRODUCERS responded akin to others ($X^2 < 7, P > 0.12$ in both cases).

Financing compensation

When offered several funding sources (Fig. 2), majorities in both CONTRIBUTORS and NON-CONTRIBUTORS endorsed the current ER fund (78% vs. 72%, $P = 0.11$). Because the ER fund was the first option in the survey instrument, we explored an order effect (primacy without subtraction sensu Smyth et al. 2006). However, the 6th and 7th options received higher endorsement than those preceding or following them (Fig. 2), hence order effects after the first choice appeared to be absent. None of the other funding sources garnered a majority from both groups. Indeed CONTRIBUTORS and NON-CONTRIBUTORS disagreed about all other potential funding sources ($P < 0.051$ in all cases; Fig. 2). NON-CONTRIBUTORS held more diverse opinions (as might be expected from a group four times larger). For example, 41% of NON-CONTRIBUTORS endorsed compensation paid from “hunting fees” and 38% favored payments from “private wildlife

Fig. 2 Responses to “As wolf numbers increase, new sources of funding will need to be located to provide reimbursement payments for wolf depredation on livestock or pets. Which of the following sources do you believe should contribute to funding a compensation program?” Responses arrayed in order of presentation on the survey instrument. * $P < 0.025$



conservation organizations”, but only 17% of NON-CONTRIBUTORS endorsed both funding sources.

Rules governing compensation

With the preamble “Since 1982 the WDNR has compensated livestock producers and game farmers for verified losses of domestic animals to wolves. Bear hunters have also been paid if wolves harm their hounds while on public land...” we presented three common scenarios related to wolf depredations (Table 3). Majorities of both CONTRIBUTORS and NON-CONTRIBUTORS agreed on the most popular livestock compensation options—“...only if government agents find evidence of a wolf” and “...only if he/she is following best management practices (e.g., disposing of dead animals properly, calving near the barn)”. They differed only with respect to the less popular options (Table 3). CONTRIBUTORS who were LIVESTOCK PRODUCERS responded similarly to others in both livestock scenarios ($X^2 < 5$, $P > 0.09$ in both).

Table 3 Responses to questions about preconditions for compensation for wolf damage in Wisconsin

Scenario...	...Response options	CONTRIBUTORS (%)	NON-CONTRIBUTORS (%)	Pearson contingency ztest
If an individual believes he/she has lost a farm animal to a wolf, he/she should...	...be compensated no matter how he/she is managing his/her livestock	10	27	39*
	...be compensated only if he/she is following best management practices (e.g., disposing of dead animals properly, calving near the barn)	84	62	
	...not be compensated	6	11	
If an individual believes he/she has lost a farm animal to a wolf, he/she should...	...be compensated whether or not he/she can produce evidence of a wolf	5	12	20*
	...be compensated only if government agents find evidence of a wolf	90	77	
	...not be compensated	5	11	
If an individual believes his or hunting dog has been injured or killed by a wolf while it was on public land, he/she should...	...be compensated whether or not he/she can produce evidence of a wolf	3	10	20*
	...be compensated only if government agents find evidence of a wolf	43	50	
	...not be compensated	54	40	

Comparing CONTRIBUTORS to NON-CONTRIBUTORS, * $P < 0.0001$

Table 4 Responses to alternative wolf damage payment approaches

Questionnaire statement	CONTRIBUTORS	NON-CONTRIBUTORS	Pearson contingency test
Reimburses livestock and game producers for preventive measures to reduce predation losses (e.g., guard dogs, electric fences)	Desirable = 62% Neutral = 21% Undesirable = 17%	Desirable = 47% Neutral = 25% Undesirable = 28%	18*
Creates tax credits for livestock and game producers who sustain wolf losses/damages	Desirable = 65% Neutral = 19% Undesirable = 16%	Desirable = 52% Neutral = 23% Undesirable = 25%	17*
Pays property owners if wolves successfully den on their property.	Desirable = 44% Neutral = 33% Undesirable = 23%	Desirable = 23% Neutral = 33% Undesirable = 44%	49*

Comparing CONTRIBUTORS to NON-CONTRIBUTORS, * $P < 0.01$

Few respondents endorsed payments for lost hunting dogs, with the plurality endorsing no compensation at all (Table 3). CONTRIBUTORS who were HUNTERS responded similarly to other CONTRIBUTORS ($X^2 = 2$, $P = 0.36$).

A greater proportion of CONTRIBUTORS endorsed alternative payment methods than among NON-CONTRIBUTORS (Table 4). The two most desirable methods were “tax credits” and “reimbursements for preventive measures”. Among CONTRIBUTORS, LIVESTOCK PRODUCERS did not differ from others ($X^2 < 8$, $P > 0.10$ in all three cases). “Pays property owners if wolves successfully den on their property” was least popular. Although that option won a plurality of all CONTRIBUTORS (Table 4), many of the LIVESTOCK PRODUCERS among them opposed it (36% undesirable vs. 19%: $X^2 = 15$, $P = 0.005$).

Wolf control

CONTRIBUTORS favored non-lethal methods of wolf control whereas NON-CONTRIBUTORS found every lethal method more desirable (Table 5). CONTRIBUTORS and NON-CONTRIBUTORS disagreed most about “a program that gives livestock owners the right to kill wolves on their own land” and “hunting by the public as a way to control the numbers of wolves”.

NON-CONTRIBUTORS were more likely to support a hunting/trapping season as soon as biologists deemed it sustainable, whereas CONTRIBUTORS more often endorsed it when depredations became unmanageable (Table 5). CONTRIBUTORS who were HUNTERS responded more positively to the idea of a wolf hunt than did other CONTRIBUTORS ($X^2 = 19$, $P = 0.0002$). A plurality of CONTRIBUTORS who were HUNTERS (38%) endorsed a season when depredations became unmanageable followed closely (36%) by those who endorsed a hunting/trapping season when biologists deemed it sustainable (compared with 45 and 17% respectively among NON-HUNTER CONTRIBUTORS). Among CONTRIBUTORS, HUNTERS opposed a season less than non-HUNTERS (“No, never”: 20 and 38%, respectively) and more chose “Yes, immediately” (6 vs. 0%). Thus, whether or not CONTRIBUTORS hunted was more likely to distinguish their responses regarding killing wolves, than was their status as livestock producers.

Table 5 Responses to alternative methods of lethal and non-lethal wolf control

Questionnaire statement	CONTRIBUTORS	NON- CONTRIBUTORS	Pearson contingency test
“How would you view...			
...a program that uses government personnel to kill wolves in areas where livestock has been attacked.”	Desirable = 23% Neutral = 19% Undesirable = 58%	Desirable = 41% Neutral = 23% Undesirable = 36%	43*
...a program that gives livestock owners the right to kill wolves on their own land.”	Desirable = 31% Neutral = 18% Undesirable = 51%	Desirable = 59% Neutral = 18% Undesirable = 23%	84*
...a program that uses hunting by the public as a way to control the numbers of wolves.”	Desirable = 31% Neutral = 19.5% Undesirable = 49.5%	Desirable = 52% Neutral = 19% Undesirable = 29%	63*
...a program that uses non-lethal methods to harass wolves (such as guard dogs, rubber bullets, electric fences).”	Desirable = 55% Neutral = 22% Undesirable = 23%	Desirable = 37% Neutral = 26% Undesirable = 37%	23*
If a wolf kills livestock, authorities should...			
Use one of three non-lethal options ^a	86%	65%	
...kill the wolf	14%	35%	41*
If a wolf kills a hunting dog on public land, authorities should...			
Use one of three non-lethal options ^a	81%	73%	
...kill the wolf	9%	27%	43*
Do you believe there should be a public hunting/trapping season on wolves?			
Yes, immediately	3%	19%	
Yes, as soon as biologists think the wolf population can sustain annual harvests	27%	41%	71*
Yes, but only when depredations become unmanageable	41%	27%	
No, never	29%	13%	

Comparing CONTRIBUTORS to NON-CONTRIBUTORS, * $P < 0.0001$ in all cases

^a Three choices: “...take no immediate action toward the wolf, but monitor the situation.”

“...capture and relocate the wolf to a wilderness area”

“...try to frighten the wolf away or deter it from approaching livestock”

Results of public hearings and interviews with elected officials

Of 410 people attending public hearings on proposed revisions to reduce payment costs, only 8 (1.9%) registered support for the proposed changes. The minutes revealed most attendees opposed the deductible and the cap on payments. Many objected to the “5-mile rule” and thought the WDNR should continue to reimburse owners for all hunting dogs killed by wolves. Written commentary was more divided. Thirty-one (37%) of 83 individuals wrote to oppose paying for dogs killed by wolves, but another 39 (47%) sent form letters in favor. The WDNR received another 1,131 form-letter emails urging a cap on compensation and a halt to payments for hunting dogs and pets (399 from in-state and 732 from out-of-state). A similar number of form-letter emails (1,145) opposed caps and deductibles. Following public comment, the WDNR abandoned price caps, deductibles, and “best management practices” (the latter proved too difficult to define: R. Jurewicz,

unpublished notes from WDNR meetings). The WDNR advanced the “5-mile rule”, “sunset” clause, and payments for missing livestock, to the WI legislative committees. The committees voted 19-0 against the “5-mile rule”. They allowed the “sunset” clause as written and the payment rules for missing livestock with minor rewording.

Seven members of the legislative committees or their aides offered various explanations for the decision to block cost-saving rule changes. “It’s intensity [of complaints] not numbers”, stated one representative. An aide to a different representative offered, “We took one look at the numbers [opposing the proposal] from the public [hearings] and sent it back to the WDNR”. As one committee member elected from a district with no wolves but many CONTRIBUTORS opined, “I’m sure most [contributors] wouldn’t like to know their contributions paid for some hunter’s dog killed by wolves while he sat drinking beer in his [truck], but we knew we were going to lose this one and we had other important battles to fight”. But one committee member representing a district within the wolf’s range said removing compensation would turn, “bear hunters into adversaries of wolves”, and added, “you could say the wolves came back on their own, but the WDNR is to blame for moving wolves around and protecting depredators. They must somehow pay”. A fifth predicted, “...wolves would lose [if] caught in the cross-fire.”

Discussion

Since the 1970s wolves have recolonized much of their former range in the western Great Lakes region without reintroduction or other direct human intervention (Wydeven et al. 2009). Yet few respondents to our survey saw losses to wolves as a natural part of raising livestock in the region. Instead, two-thirds endorsed compensation for wolf damage to livestock—provided the producers followed best management practices and evidence existed of wolf culpability. A slim majority agreed that payments should continue when wolves are no longer threatened or endangered; only 27% disagreed. Nearly three-quarters endorsed continued use of voluntary donations to the state fund that pays for management of endangered species. In short, respondents as a whole favored the status quo as it stood in 2004.

However, the attitudes of contributors to the compensation fund differed from those of non-contributors in many ways. Contributors favored non-lethal over lethal management in response to wolf damages (Table 5), including public reimbursement for preventive measures installed on private properties. Contributors endorsed all payments more strongly—except for hunting dogs injured or killed on public land. They also favored more varied sources of funds for compensation and more varied payment mechanisms. By contrast, a greater proportion of non-contributors thought wolf damages were a part of raising livestock that should not be compensated. In every case but one, livestock producers who were also contributors held the same views as contributors who were not livestock producers. The exception was opposition among livestock producer-contributors to conservation performance payments “Pays property owners if wolves successfully den on their property”. This parallels opposition among Swedish Sami reindeer herders to accepting incentives for wolf conservation even as they accept such payments for wolverine (*Gulo gulo*), brown bear, and lynx (*Lynx lynx*) conservation (Zabel and Holm-Muller 2008).

Three broader conclusions emerged: (1) compensation is popular; (2) special-interest politics impede efforts to phase out or reduce payments; and (3) donors and recipients will disagree and want to influence policy beyond compensation. We treat each of these conclusions individually below.

Compensation is popular

Compensation is used worldwide, particularly for carnivores (Montag 2003; Nyhus et al. 2003). For example, at least 24 European countries paid for large carnivore damage throughout the 1990s and many also paid for hunting dogs killed by wolves (Breitenmoser and Angst 2001; Linnell and Broseth 2003). More than 19 US states have wildlife compensation programs drawing from a variety of funding sources (Wagner et al. 1997). Although less common in less-wealthy countries, the compensation programs that do exist often focus on carnivores (Hötte and Bereznuik 2001; Karanth and Madhusudan 2002; Cilliers 2003; Nemtsov 2003; Hazzah 2006; Rodriguez 2008). Given the widespread use of compensation, public opinion regarding payment rules merits closer examination.

Comparing attitudes to compensation between WI and the Northern Rocky Mountain region (NRM) is illuminating because the three NRM states experienced a significantly different wolf recovery and compensation history. The USFWS physically reintroduced wolves to the NRM (Bangs et al. 1998), which could bolster arguments about a “taking” after private property was lost (*sensu* Thompson 1997). Also Defenders of Wildlife, a Washington, DC conservation group, paid for wolf damage from private funds (Phillips and Smith 1998; Wildlife 2008). Thus, claimants and interest groups had less opportunity to negotiate payment rules publicly than they did in WI. We expected different attitudes to compensation in NRM than in WI, yet we found few. Montag et al. (2003) surveyed 1959 randomly selected residents of the NRM living within and near the range of the wolf (43.9% response rate). About half disagreed with the statement “Losses/damages caused by predators are a cost of doing business and should not be compensated”, similar to the 62% in WI who disagreed with the nearly identical statement (Table 2). Likewise 39–50% of their three-state sample agreed with the statement “Compensation programs spread costs related to predator conservation more fairly within society”, compared to 42% in our overall sample. Thus the two goals of spreading costs and compensating livestock producers for their losses were viewed similarly in the two regions. However, the goal of raising tolerance through compensation failed in both regions, judging from responses to the statement “My tolerance for wolves would decrease if compensation were no longer available”; agreement was low in the NRM (31–33%, Montag et al. 2003) and even lower in WI (26% for our overall sample). Societal tolerance for wolves seems to change slowly (Williams et al. 2002; Heberlein and Ericsson 2005; Bruskotter et al. 2007) and compensation does not seem to change individuals’ attitudes toward wildlife (Naughton-Treves et al. 2003). Interestingly, attitudes to wolves seemed more positive than attitudes to the donors to compensation funds in the NRM: 59–63% agreed “Programs funded by environmental groups are publicity stunts that do not address the real issues” (Montag et al. 2003). Half as many of our respondents agreed with a similar statement. Nevertheless, NRM respondents strongly endorsed payments from “Environmental/wildlife groups” (71–77%) and “Private donations” (67–73%) over other options—in particular, livestock owners endorsed distribution of the costs across society (Montag et al. 2003). Likewise our WI respondents favored the existing state voluntary donation system over other options. Perhaps respondents in the NRM and WI both preferred private donations to spending public money, or feared an end to compensation if the funding mechanism were changed. Together, differences in attitudes between these two regions suggest respondents saw compensation payments in a similar light, but viewed wolves, donors, or the federal government differently. Researchers from other regions have also noted the many factors that shape individual perceptions of carnivores including views of government and other members of society (Ericsson et al. 2004, 2007; Heberlein and Ericsson 2005; Karlsson 2007; Karlsson and Sjöström 2007).

The popularity of compensation poses two problems for the management of recovering endangered species. First costs will mount as recovery succeeds—a perverse outcome for those who assume the costs of conservation are highest when a species is vanishing. Second, recipients may feel a sense of entitlement to perpetual compensation and assume that we should have predator-free landscapes. These problems in turn raise Doremus' (1999) specter of creating expectations of government liability for wildlife. For example, the U.S. “Gray Wolf Livestock Loss Mitigation Act” (S. 2875) would authorize federal money for state trust funds to reimburse NRM livestock owners for wolf damage: “The federal government put these wolves in Wyoming and Montana... This bill will make them take financial responsibility for the damage they cause.” (State Senator Barrasso, Wyoming, www.opencongress.org/bill/110-s2875/text).

Finally, despite the political defeat of cost-saving revisions to WI's compensation program, most of our respondents were concerned about rising costs, including nearly half of those endorsing perpetual wolf compensation. Perhaps the overall popularity of compensation would have diminished had we explored trade-offs, such as “Would you rather pay for wolf damage or release more whooping cranes?” Such situation-dependent contingency is crucial to understanding nuance of attitudes (cf. Decker et al. 2006) and this deserves closer attention in future research.

Special interest politics impede efforts to phase out or reduce payments

WI's politicians responded to vocal interest groups to back unpopular payments (e.g., hunting dogs and/or unverified losses). They sought to avoid accusations of indifference to directly affected constituencies. Some hinted at “choosing their battles”. As a result, state politicians responded to interest group demands and over-ruled their WDNR mid-level and field staff, the generally silent contributors to the compensation fund, and conclusions from three surveys of public attitudes (Naughton-Treves et al. 2003; this study; Schanning 2009). For example, majorities in three surveys wanted evidence of wolf culpability (in contrast to payments for missing calves added in 2005), best livestock management practices (dropped from rule revisions in 2005), and no payments for hounds (payments upheld in 2005). Evidence of wolf culpability might be particularly important where other carnivores also cause damage. For example, coyotes *Canis latrans* and black bears *Ursus americanus* cause more property damage in WI than do wolves (Treves et al. 2002; USDA-WS 2005; Kapp 2006) so compensating for one but not the other requires careful verification (Roberts 1986) and may open the door to error, negligence, or fraud (Montag 2003). On the other hand, verification itself becomes more costly with a population of 500–600 wolves.

Expanding payments to cover missing livestock, dropping the criterion of best management practices, and paying for damage to hunting dogs running free on public land may discourage prudent protection of property—a moral hazard. Moral hazards are more likely to arise when recipients have disproportionate influence over rules for payments. We observed that contributors held less sway than recipients because contributors donated anonymously, limiting their effectiveness as a lobbying group (Treves 2008). After the final compensation rule was published in 2005, several contributors wrote letters to the WDNR opposing the use of their money to pay for hunting dogs injured or killed by wolves (R. Jurewicz, WDNR files). One contributor protested in an editorial stating, “A portion of [our donations] pay bear hunters who go crashing through the woods with baying hounds terrifying wild animals and cornering them somewhere to blow them away.” (Editorial, Capital Times, August 2005). Although certain contributors may oppose

certain payments, the *per capita* cost of expanding compensation diffuses the costs across thousands of contributors.

Politicians may find payments an easier path to reconciliation between conflicting interest groups than taking a hard stance on controversial interventions (e.g., lethal control) or incompatible activities (e.g., running dogs freely on public land occupied by wolves). But there are risks; responding to minority interest groups is common in US wildlife policy arenas (Gill 1996), and has resulted in demonstrations and ballot initiatives, which have reduced the authority or flexibility of wildlife agencies (Gill 1996; Torres et al. 1996; Jacobson and Decker 2008; Treves 2008).

Donors and recipients will want to influence policy beyond compensation

Many people view compensation as incompatible with lethal control or hunting of carnivores (Thompson 1997; this study Table 5). Killing carnivores could result in a loss of financial support from donors. Over a quarter of contributors in our survey opposed any future hunting or trapping of wolves. If this opposition turns into withheld contributions, the compensation fund might lose over USD 500,000 annually (see revenues in “Methods”). Recouping such a loss through hunting might require trophy fees (itself a controversial proposition). On the other hand, if WI wolves became game, shifting the burden for damage payments to a new constituency would likely result in other rule changes. Compensation for damage by game animals is currently more restrictive than compensation for damage by endangered species (WDNR 2005). The former does not include payment for missing livestock, losses of farmed deer, injured animals, or dead dogs. Policy-makers preparing to reclassify a threatened/endangered species as game may find themselves drafting new rules, and negotiating with constituencies who value wildlife in different ways.

Summary

Underlying the debate over compensation are disparate visions of carnivores amidst human-dominated landscapes. In the case of the wolf, managers publicly admit weariness of public controversy and wish to manage wolves as they do other species. Yet wolves trigger stronger and sometimes qualitatively different responses in people than do other wildlife (Ericsson et al. 2007; Zabel and Holm-Muller 2008). For example, unlike with wolves, there were no calls for perpetual compensation when WI terminated compensation for bald eagle (*Haliaeetus leucocephalus*) and double-crested cormorant (*Phalacrocorax auritus*) damages. Other carnivores in other regions evoke similar controversy (Torres et al. 1996; Jackson and Wangchuk 2001; Knight 2003). Compensation raises broader questions about the ownership of wildlife and the role of government. Although the US public may own wildlife *de jure*, it seems interest groups are *de facto* owners of the wildlife for which they pay (Gill 1996; Heberlein 2000). However, when donors as a group are disorganized or quiet, those who suffer directly from wildlife damages can control the debate for some time (Zabel and Holm-Muller 2008). When this occurs, policy-makers will find it difficult to decrease payments as circumstances change. Thus, we recommend formulating clauses at the outset that permit adaptive management. For example, policy-makers should articulate explicit goals for compensation programs lest the costs skyrocket without measurable success.

Wildlife compensation programs will likely continue to expand given their popularity and the recent trend toward direct payments for conservation (Ferraro and Kiss 2002).

Mounting costs and changing rules may require additional donors who may demand a voice in wildlife policy beyond compensation rules, such as control of wildlife damage and wildlife-use regulations. In many countries, carnivore policy will likely be hammered out in courts, stakeholder meetings, and the press for years to come.

Finally, our study suggests many factors relating to politics, values, and public perceptions supersede cost-efficiency in the design of compensation (contra Schwerdtner and Gruber 2007). Thus, we recommend inclusion of both donors and recipients in decision-making to avoid moral hazards that can exacerbate conflicts with wildlife and generate lawsuits, ballot initiatives, and other expressions of dissatisfaction that can undermine wildlife managers and locally negotiated compromises.

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References

- Bangs EE et al (1998) Status of gray wolf restoration in Montana, Idaho and Wyoming. *Wildl Soc Bull* 26:785–793
- Blume L, Rubinfeld B (1984) Compensation for takings: an economic analysis. *Calif Leg Rev* 569:620–621
- Breitenmoser U, Angst C (2001) Statistics of damage caused by large carnivores in Europe. *Carniv Damage Prev News* 4:11–13
- Brown JS (1995) Restoration ecology: living with the prime directive. In: Bowles ML, Whelan CJ (eds) *Restoration of endangered species*. Cambridge University Press, Cambridge, pp 355–380
- Bruskotter JT et al (2007) Are attitudes toward wolves changing? A case study in Utah. *Biol Conserv* 139:211–218
- Bulte EH, Rondeau D (2005) Why compensating wildlife damages may be bad for conservation. *J Wildl Manag* 69:14–19
- Cilliers D (2003) South African cheetah compensation fund. *Carniv Damage Prev News* 6:15–16
- Decker DJ et al (2006) Situation-specific “impact dependency” as a determinant of management acceptability: insights from wolf and grizzly bear management in Alaska. *Wildl Soc Bull* 34:426–432
- Dillman DA (2007) *Mail and Internet surveys: the tailored designed method*. John Wiley & Sons, New York
- Doremus H (1999) Restoring endangered species: the importance of being wild. *The Harvard Environmental Law Review* 23
- Ericsson G et al (2004) Support for hunting as a means of wolf *Canis lupus* population control in Sweden. *Wildl Biol* 10:269–276
- Ericsson G et al (2007) Wolves as a symbol of people's willingness to pay for large carnivore conservation. *Soc Nat Resour* 21:294–309
- Ferraro PJ, Kiss A (2002) Direct payments to conserve biodiversity. *Science* 298:1718–1719
- Finance JCo (2005) *Endangered resources funding, Paper #507*. Legislative Fiscal Bureau, Wisconsin Department of Natural Resources, Madison
- Fritts SH et al (1992) Trends and management of wolf-livestock conflicts in Minnesota. US Fish and Wildlife Service, Resource Publication 181, Washington, DC
- Gill RB (1996) The wildlife professional subculture: the case of the crazy aunt. *Human Dimens Wildl* 1:60–69
- Hazzah L (2006) Living among lions (*panthera leo*): coexistence or killing? Community attitudes towards conservation initiatives and the motivations behind lion killing in Kenyan Maasailand. Nelson Institute for Environmental Studies. University of Wisconsin, Madison
- Heberlein TA (2000) The gun, the dog and the thermos: culture and hunting in Sweden and the United States. *Swed Am Fall* 2000:24–29
- Heberlein TA, Ericsson G (2005) Ties to the countryside: accounting for urbanites attitudes toward hunting, wolves, and wildlife. *Human Dimens Wildl* 10:213–227
- Hötte M, Bereznuik S (2001) Compensation for livestock kills by tigers and leopards in Russia. *Carniv Damage Prev News* 3:6–7

- Jackson R, Wangchuk R (2001) Linking snow leopard conservation and people-wildlife conflict resolution: grassroots measures to protect the endangered snow leopard from herder retribution. *Endanger Species Updat* 18:138–141
- Jacobson CA, Decker DJ (2008) Governance of state wildlife management: reform and revive or resist and retrench? *Soc Nat Resour* 21:441–448
- James JM, Bolstein R (1992) Large monetary incentives and their effect on mail survey response rates. *Public Opin Q* 56:442–453
- Kapp K (2006) Socioecological correlates of human–black bear conflict in northern Wisconsin. Nelson Institute for Environmental Studies. University of Wisconsin, Madison
- Karant H, Madhusudan MD (2002) Mitigating human–wildlife conflicts in southern Asia. In: Terborgh J et al (eds) *Making parks work: identifying key factors to implementing parks in the tropics*. Island Press, Covelo, pp 250–264
- Karlsson J (2007) Management of wolf and lynx conflicts with human interests. Doctoral dissertation. Department of Ecology, SLU. *Acta Universitatis agriculturae Sueciae* vol 2007:59
- Karlsson K, Sjöström M (2007) Human attitudes towards wolves, a matter of distance. *Biol Conserv* 137:610–616
- Knight J (2003) *Waiting for wolves in Japan*. Oxford University Press, Oxford
- Linnell JDC, Broseth H (2003) Compensation for large carnivore depredation of domestic sheep. *Carniv Damage Prev News* 6:11–13
- Mech LD (1998) Estimated costs of maintaining a recovered wolf population in agricultural regions of Minnesota. *Wildl Soc Bull* 26:817–822
- Montag J (2003) Compensation and predator conservation: limitations of compensation. *Carniv Damage Prev News* 6:2–6
- Montag J et al (2003) Political & social viability of predator compensation programs in the west. School of Forestry, University of Montana, Missoula, 138 pp
- Naughton-Treves L et al (2003) Paying for tolerance: the impact of livestock depredation and compensation payments on rural citizens' attitudes toward wolves. *Conserv Biol* 17:1500–1511
- Nemtsov SC (2003) A short-lived wolf depredation compensation program in Israel. *Carniv Damage Prev News* 6:16–17
- Nie M (2003) *Beyond wolves: the politics of wolf recovery and management*. University of Minnesota Press, Minneapolis
- Nyhus PJ et al (2003) Taking the bite out of wildlife damage: the challenges of wildlife compensation schemes. *Conserv Pract* 4:37–40
- Phillips MK, Smith DW (1998) Gray wolves and private landowners in the Greater Yellowstone Area. *Trans N Am Wildl Nat Resour Conf* 63:443–450
- Refsnider R (2009) The role of the endangered species act in midwest wolf recovery. In: Wydeven AP et al (eds) *Recovery of gray wolves in the Great Lakes region of the United States: an endangered species success story*, Chap 20. Springer, New York
- Roberts DH (1986) Determination of predators responsible for killing small livestock. *S Afr J Wildl Res* 16:150–152
- Rodriguez SL (2008) Perceptions and attitudes of a Maasai community regarding wildlife-damage compensation, conservation, and the predators that prey on their livestock. *Human Dimens Wildl* 13:205–206
- Schanning K (2009) Human dimensions: public opinion research concerning wolves in the Great Lakes States of Michigan, Minnesota, and Wisconsin. In: Wydeven AP et al (eds) *Recovery of gray wolves in the great Lakes region of the United States: an endangered species success story*. Springer, New York
- Schwerdtner K, Gruber B (2007) A conceptual framework for damage compensation schemes. *Biol Conserv* 134:354–360
- Smyth J et al (2006) Comparing check-all and forced-choice question formats in web surveys. *Public Opin Q* 70:66–77
- Stroup R (1997) The economics of compensating property owners. *Contemp Econ Policy* XV(4):55–57
- Thompson JG (1993) Addressing the human dimensions of wolf reintroduction: an example using estimates of livestock depredation and costs of compensation. *Soc Nat Resour* 6:165–179
- Thompson BH Jr (1997) The endangered species act: a case study in takings & incentives. *Stanf Law Rev* 49:305–380
- Torres SG et al (1996) Mountain lion and human activity in California: testing speculations. *Wildl Soc Bull* 24:457–460
- Treves A (2008) Beyond recovery: Wisconsin's wolf policy 1980–2008. *Human Dimens Wildl* 13:329–338
- Treves A et al (2002) Wolf depredation on domestic animals: control and compensation in Wisconsin, 1976–2000. *Wildl Soc Bull* 30:231–241

- Treves A et al (2004) Predicting human-carnivore conflict: a spatial model based on 25 years of wolf predation on livestock. *Conserv Biol* 18:114–125
- USDA-WS (2005) Wildlife services annual tables. United States Department of Agriculture, Animal Plant health Inspection Service, Wildlife Services
- USFWS (2009) Final rule to identify the western great lakes populations of gray wolves as a distinct population segment; final rule to identify the northern Rocky Mountain population of gray wolf as a distinct population segment; and to revise the list of endangered and Federal Register Notice: threatened wildlife. *Fed Regist* 74:15070–15123
- Wagner KK et al (1997) Compensation programs for wildlife damage in North America. *Wildl Soc Bull* 25:312–319
- WDNR (2005) Wisconsin's Fish & Wildlife Annual Report 2004–2005. PUB-CE-259 2006. Wisconsin Department of Natural Resources, Madison
- WDNR (2007a) Guidelines for conducting depredation control on wolves in Wisconsin following federal delisting: guidelines for 2007–2008. Wisconsin Department of Natural Resources, Park Falls
- WDNR (2007b) Wisconsin Wolf Management Plan 2007 Revision. Wisconsin Department of Natural Resources, Madison
- Wildlife Do (2008) The Bailey wildlife foundation wolf compensation trust, Washington, DC
- Williams CK et al (2002) A quantitative summary of attitudes toward wolves and their reintroduction (1972–2000). *Wildl Soc Bull* 30:575–584
- Wilson MA (1999) Appendix H: public attitudes towards wolves in Wisconsin. Wisconsin Department of Natural Resources, Madison
- Wydeven AP et al (eds) (2009) Recovery of gray wolves in the great Lakes region of the United States: an endangered species success story. Springer, New York
- Zabel A, Holm-Muller K (2008) Conservation performance payments for carnivore conservation in Sweden. *Conserv Biol* 22:247–251