Pendulum Swings in Wolf Management Led to Conflict, Illegal Kills, and a Legislated Wolf Hunt

Erik R. Olson1,2, Jennifer L. Stenglein3, Victoria Shelley4, Adena R. Rissman3, Christine Browne-Nuñez1, Zachary Voyles1, Adrian P. Wydeven5, & Timothy Van Deelen3

1 Nelson Institute for Environmental Studies, University of Wisconsin–Madison, Madison, WI, USA
2 Department of Natural Resources, Northland College, Ashland, WI, 54806, USA
3 Department of Forest & Wildlife Ecology, University of Wisconsin–Madison, Madison, WI 53706, USA
4 Lion Guardians, Langata, Nairobi 00509, Kenya
5 25350 South Garden Ave, Cable WI 54821 USA

Keywords
Endangered Species Act; harvest; lethal control; poaching; politics; state wildlife management; wolves.

Abstract
Rapid change in wildlife populations can challenge managers to promote species conservation while maintaining public support for wildlife. Wolf management during recolonization in Wisconsin, United States demonstrates the complexities of inconsistent management authority, public attitudes, and illegal killing of wolves. State management authority to control depredating wolves oscillated during a period of intense sociopolitical conflict over wolf status under the federal Endangered Species Act. We demonstrate that swings in wolf status led to inconsistent management authority, declining local public support for wolves, and possibly the unintended backlash of more illegal kills and a legislatively mandated public wolf hunt. A new Wildlife Management Matrix illustrates an idealized relationship between lethal control options and perceptions of wildlife. Moderating the sociopolitical drivers of swings in policy over short periods is essential to allow wildlife managers greater flexibility in achieving species-specific goals. To our knowledge, this research provides the first demonstrated link between illegal wildlife killing and management authority under the Endangered Species Act, and suggests that illegal behavior may be moderated with responsible and effective wildlife management programs. We recommend states avoid prescriptive harvest legislation, and we suggest a more incremental shift from federal to state management authority.

Introduction
Conflict over wildlife can occur when wildlife management actions are incompatible with the values of some stakeholders (Zinn et al. 1998; Shelley et al. 2011). Sociopolitical forces can reinforce conflict and trigger intractable debates, such as conflict over gray wolf, Canis lupus, management (Messmer et al. 2001; Nie 2002, 2003; Gray 2004). Interests of empowered stakeholders can determine wildlife policy (Rinfret 2011), leading to management that may be inconsistent with broader public support. Sociopolitical conflict over wildlife can be visualized as a pendulum swinging between exploitative and protective management as different stakeholder groups gain political power, producing inconsistency in wildlife management (Messmer et al. 2001). Yet, while debates occur in public meetings, board rooms, and within the legal system, the effects of sociopolitical conflict unfold on the ground between people and wildlife (Nie 2003).

Through an interdisciplinary approach, we explored the complex dynamics of wolf management options, public attitudes, and illegal killing of wolves in Wisconsin, United States. We examined the illegal killing of wolves during a period of intense sociopolitical conflict (2003–2011), and we present a Wildlife Management Matrix to visualize the interplay between public acceptance of lethal management and public perceptions of wildlife. To moderate policy swings, we recommend (1)
greater consideration of local perceptions of wildlife, (2) greater inclusion of nonconsumptive users in state wildlife management, (3) that state legislators defer to state wildlife agencies, who should aim for moderation in wolf management following delisting, and (4) consideration of a step-wise delisting process (endangered—threatened—delisted) to promote a smoother transition between federal and state management authority.

**Wolf status in Wisconsin, United States**

Between 2003 and 2012, Wisconsin wolves were relisted under the Endangered Species Act (ESA) three times because of legal challenges, which caused problematic oscillations in management authority to conduct lethal control of wolves attacking domestic animals. Wolves were listed as federally endangered under the ESA in 1974. Wolves achieved federal delisting goals in 1998: 100 animals for 5 years in Wisconsin and Michigan, and 1,250 to 1,400 animals in Minnesota.

Throughout wolf recovery the state had the authority to use non-lethal control, and they exercised it. However, only when Wisconsin wolves were reclassified as threatened in April 2003, was the state granted lethal control authority for depredating wolves. Two separate legal actions led by the National Wildlife Federation and Defenders of Wildlife resulted in the relisting of wolves as endangered in January 2005, on the basis that the Distinct Population Segment (DPS) boundaries and reclassification decisions were ‘arbitrary and capricious’ (USFWS 2013). By April 2005, the Wisconsin Department of Natural Resources (WDNR) was granted a permit to control depredating wolves (Refsnider 2009). Following another lawsuit, a U.S. District Court enjoined the permits in September 2005. The decision was based on the State’s failure to provide adequate public notice regarding their application for a permit. The court also advised that there was “…no empirical basis…” for “…the notion you kill the wolves to save the wolves.” (Defenders of Wildlife v. Norton, Civ.No. 05–1573 [D.D.C. 2005]).

Wisconsin reapplied for permits, which were issued April 2006, but revoked again by the US District Court in August 2006 (Humane Society of US v. Kempthorne, 481 F.Supp.2d 53 [D.D.C. 2006]). The court’s rationale was that the ESA provided the strictest protections for endangered species, and that lethal control of problem wolves to improve social tolerance was not justified. The court determined that the logic that “killing… depredating wolves will increase social tolerance for wolves and ultimately result in fewer illegal killings of wolves—simply applies a labyrinthian analysis that does not comply with the text of the statute on its face,” indicating an absence of evidence for the importance of lethal control in fostering tolerance of wolves.

In March 2007, wolves in the Western Great Lakes DPS were removed from the federal list of threatened and endangered species, but were relisted following a lawsuit led by the Humane Society of the United States (HSUS) in September 2008 on the basis that the United States Fish and Wildlife Service (USFWS) could not “simultaneously designate and delist DPS’s within broader listings” (USFWS 2013). Wolves were delisted in May 2009, but were relisted following a settlement agreement that resulted from legal challenges led by HSUS in July 2009 (USFWS 2013). Between July 2009 and January 2012, wolves remained federally endangered.

On 27 January 2012, wolves were delisted in the Western Great Lakes DPS (USFWS 2013). That same day, state legislators introduced Wisconsin Assembly Bill 502 to mandate the hunting and trapping of wolves in a regulated harvest, the bill also mandated various details of the harvest (e.g., season dates, harvest methods, transfer of licenses). While the WDNR needed legislative authority to create a wolf harvest, including the ability to set quotas and limit participation, traditionally the legislature has allowed the WDNR, through administrative rules, to set details such as length of season, methods, license transfers, and establishment of closed areas. Governor Walker signed Assembly Bill 502 into law in April 2012. Prior to the harvest, state-based animal protection groups sued the State of Wisconsin in Dane County Circuit Court to challenge the use of dogs for hunting wolves, which resulted in a temporary injunction against the use of dogs during 2012. The harvest began on 15 October and closed on 23 December 2012 (117 wolves harvested). In February 2013, HSUS and other groups filed suit to challenge the delisting of wolves in the Western Great Lakes DPS (USFWS 2013). This pending lawsuit marked a decade of sociopolitical debate over wolf management that had caused wolf status to oscillate. As wolf populations surpassed delisting goals (Figure 1), the sociopolitical conflict intensified. Throughout the struggle over the legal status of wolves, their population and distribution increased at a similar pace (Figure 1).

**Implications of sociopolitical conflict over wolves**

During this period of conflict, negative interactions with wolves increased faster than increases in wolf population and distribution (Figure 2). Researchers attribute increases in negative interactions to increasing wolf populations, while others have demonstrated that apart from the number of wolves, the location of wolves is also predictive (Haight et al. 2002; Harper et al. 2005).
Recently, wolf packs have established in areas with higher potential for interactions with humans and their property (Mladenoff et al. 2009). Localized lethal control could be effective at reducing negative interactions between wolves and humans (Haight et al. 2002), and governments have a responsibility to mitigate some negative interactions (Dorrance 1983).

When the state had management authority to control depredating wolves, it exercised that authority (Supplemental Material). Following delisting in 2012, 19 and 57 wolves were killed by permitted land owners and the United States Department of Agriculture Service Wildlife Services (USDA-WS), respectively. Yet, when listed as endangered, Wisconsin had no authority for lethal controls, except in cases of human safety concerns. According to Wydeven et al. (2011, 2012), 16% and 17% of the state wolf packs that attacked livestock or pets near homes would have likely been exposed to control actions in 2010 and 2011, respectively, had the state had management authority to do so. Hence, the repeated relisting of wolves as endangered resulted in reduced depredation management flexibility. For people living in wolf range, attitudes became increasingly more supportive of lethal wolf management approaches (i.e., public harvest and nuisance animal control) between 2001/2004 and 2009 (Treves et al. 2013), suggesting that legal actions preventing lethal management of depredating wolves were counter to the attitudes of some.

In its final environmental assessment for the management of depredating wolves, USDA-WS et al. (2006) reported that,

“...a wolf damage management program... is necessary and advisable to minimize negative attitudes toward wolf recovery and facilitate wolf conservation. The WDNR has identified social tolerance of wolves as one of the primary factors limiting expansion of the Wisconsin wolf population... The Wildlife Society... has stated that ‘control of wolves preying on livestock and pets is imperative and should be prompt and efficient if illegal killing is to be prevented and human tolerance of the presence of wolves is to be maintained’...” (pp. 8–9)

People who experienced wolf damage had significantly more negative attitudes toward wolves than others (Naughton-Treves et al. 2003; Browne-Nuñez et al. 2012). Changes in individual attitudes over time and across wolf range in Wisconsin indicated that between 2001/2004 and 2009 there was a 9–31% increase in negative attitudes/beliefs about wolves (Treves et al. 2013). USDA-WS et al. (2006) also expressed concern that absent some form of mitigation, tolerance of wolves will decline and illegal killing may increase.
Figure 2  Verified incidents of negative interactions with wolves (a) per wolf distribution (i.e., accumulated area occupied by wolf pack territories) and (b) per wolf (based on minimum winter count) over time (1980–2011), for Wisconsin, United States. Quadratic fit (black, solid) with 95% confidence interval (light gray) was significantly better fit for both (P = 0.035 and P = 0.058, respectively) than a linear relationship for raw data (points, tracked with black, dashed line).

“...a government which simultaneously imposes the risk of wolf depredation (i.e., supports wolf recovery) and prohibits individuals from effectively reducing those risks (i.e., no chance for removal of problem wolves) is creating an intolerance of the wolf presence… If no government-sanctioned relief from the loss of livestock is in sight, intolerant stakeholders will likely adopt anti-wolf behaviors including illegal killing…” (pp. 26–27)

Researchers have demonstrated that attitudes often predict behaviors (Fishbein & Ajzen 2010); therefore, observed declines in positive attitudes toward wolves may coincide with increases in illegal killing of wolves. In focus groups held in Wisconsin’s wolf range, farmers, bear hunters and deer hunters expressed frustration with federal involvement in wolf management, feeling it “tied the hands” of the WDNR (Browne-Nuñez et al. 2012). They expressed a strong fear of wolves and did not feel empowered in issues of wolf management. Anonymous questionnaire responses revealed most (n = 45, 71%) focus group participants “would try to kill a wolf in certain situations even though it currently is illegal” (Browne-Nuñez et al. 2012, p. 5). This suggests that frustrations over wolf management and a lack of empowerment may lead to increased willingness to participate in illegal killing (Madden 2004; Goldman et al. 2013). The percentage of hunter respondents who reported that they were inclined to kill wolves illegally increased by 6% between 2001/2004 and 2009 (Treves et al. 2013).

We examined illegal wolf kill data from the WDNR (2003–2011) relative to proportion of the year with state management authority to kill depredating wolves (Supplemental Material; Wydeven et al. 2009, 2011, 2012; Stenglein 2014). We found that indices of illegal killing
were inversely related to the proportion of the year with state management authority. These trends were evident when we examined the percent of known mortality attributed to illegal kills for all wolves ($P = 0.08$; adjusted $R^2 = 0.28$) and for radio-collared wolves ($P = 0.009$; adjusted $R^2 = 0.59$; Figure 3). We found that the proportion of radio-collared wolves illegally killed was also negatively correlated with the proportion of the year with state management authority ($P = 0.001$; adjusted $R^2 = 0.76$; Figure 3). Furthermore, the probability of a radio-collared dead wolf being the result of illegal activity was doubled following summers without lethal control compared to summers with lethal control (Supplemental Material).

Throughout the study period (2003–2011) 222 wolves were legally killed while a minimum of 390 wolves are estimated to have been illegally killed (Supplemental Material). Beyond the numbers of wolves, illegal killing may also have human social costs (i.e., undermine support for the law), and is only one measure of the consequences of declining tolerance toward wolves—which may not be fully realized thus far.

For example, the sociopolitical conflict and local frustration with wolf management may have set the stage for a legislatively mandated wolf hunt (117 and 257 wolves were harvested in 2012 and 2013, respectively). Traditionally, hunting seasons are instituted under the rule-making authority of the WDNR, an executive branch agency. The passage of the harvest was followed by litigation at both the state and federal level. According to Nie (2002, p. 59).

"The issue of hunting and trapping wolves after they become de-listed is perhaps the most divisive ... issue in the entire wolf debate. It engenders the type of emotion and deep-core values that make conflict resolution nearly impossible to achieve. It also means that the courtroom may likely continue to be the venue in which this conflict plays out."

In Wisconsin, research (Treves et al. 2013) demonstrates that some residents accept and are willing to participate in a wolf hunt. A total of 20,272 and 16,672 individuals applied to receive a wolf harvest permit in 2012 and 2013, respectively. However, other residents want further protections for the wolf (e.g., Shelley et al. 2011). This would call for a cautious and tempered approach to wolf harvest design to avoid litigation and sociopolitical conflict.

**Wildlife management matrix**

Public support for discrete wildlife management actions is, in part, influenced by perceptions of wildlife populations and risk (Zinn et al. 1998; Reiter et al. 1999). We acknowledge that other factors such as species identity and life history (e.g., large felids vs. rodents, K- vs. r-selected species), cultural traditions (e.g., Shelley et al. 2011), experience (Kaltenborn et al. 2006), emotions (Vaske et al. 2013), normative beliefs (Zinn et al. 1998), and education (Shelley et al. 2011) can influence acceptability of wildlife management actions. However, to illustrate an idealized interaction between changes in wolf management authority and public attitudes toward lethal control...
Figure 4 The Wildlife Management Matrix is a conceptual diagram of public acceptance for lethal control options for predators, ranging from protective to exploitative. As perceptions of wildlife population and risk of human-wildlife conflict increase, public acceptance for more exploitative management options increases. We visualize public support as having an idealized maximum (black boxes) centered over the most exploitative lethal control option with relatively broad public support. Enacting lethal control options that are more protective or more exploitative than the idealized maximum may lead to greater social or political backlash. HHS Protection = Human health and safety protection; a fundamental basic responsibility of the government. Nuisance Animal Control = reactive management of problem animals, targeting wildlife depredating livestock or pets. Landowner Permit = more liberal nuisance animal management which empowers landowners with past nuisance problems to manage problem wildlife, considered more proactive. Intensive Local Control = liberal and proactive governmental and landowner control targeting specific areas determined to have a high probability of future interactions. Public Harvest = use of public harvest to manage a wildlife population. Vermin Control = programs or laws that incentivize or remove barriers to the removal of individuals, mainly with the goal of dramatically reducing the population.

options we assume that perceptions of wildlife populations and risk of human–wildlife conflict can be used to identify a range of management actions that would be acceptable to different groups (e.g., the residents of Wisconsin; Figure 4). In essence, we expect the members of the public to support more exploitative management if they perceive the species to be both common and causing problems (Zinn et al. 1998; Reiter et al. 1999). Alternatively, we expect the general public to be less supportive of exploitative management if a species is perceived to be rare, but with high perceived risk of human–wildlife conflict. We visualize public support as having an idealized maximum centered over the most exploitative lethal control option with relatively broad public support (Zinn et al. 1998; Reiter et al. 1999). We expect variation around the idealized maximum (e.g., mean with standard error bars) because public support fluctuates, especially for more exploitative management actions, which are often more controversial (Nie 2003; Mech 2010). This matrix provides a conceptual basis from which state wildlife managers can begin to ask questions about the most ideal management action, particularly as species recover from low population levels. For example, in its simplest form the matrix suggests that successful management decisions are contingent upon the perceptions of their stakeholders, particularly perceptions of wildlife abundance and risk of human–wildlife interaction. More intricately, the matrix suggests that enacting lethal
control options that are more protective or more exploitative than what the public is willing to accept (i.e., idealized maximum) may lead to greater social or political backlash. However, it should be noted that in some cases public acceptance of certain management actions may not align with conservation goals or scientific understandings. In these cases social or political backlash is difficult to avoid, however, education and marketing campaigns may help increase support for management decisions.

This diagram also helps us understand the swings of the policy pendulum relative to changes in stakeholder perceptions for large carnivores. For example, relisting wolves as endangered limited the state’s lethal control options to only those addressing human safety concerns, when many in wolf range were more accepting of public harvest and nuisance animal control (Treves et al. 2013). This hypothetically placed lethal control options for wolves outside of the idealized maximum (Figure 4), likely leading to greater sociopolitical conflict. While management authority may change over time, attitudes can also change (Messmer et al. 2001; Treves et al. 2013), again suggesting that education and marketing campaigns may be useful in increasing support for management decisions.

Moderating the arc and frequency of the pendulum

Moderating sociopolitical processes that perpetuate swings in policy over short periods is essential to allow state wildlife managers greater consistency and flexibility in achieving species-specific goals (Messmer et al. 2001). Since protection of a colonizing wolf population was enacted by the federal government, public agencies must mitigate some of the negative consequences (Dorrance 1983; USDA-WS et al. 2006), and this responsibility typically falls mostly on state agencies. Nonlethal controls are a good alternative to lethal control and have been shown to be effective, in both cost and conflict reduction, in some situations (McManus et al. 2014). Furthermore, the use of lethal controls has drawn criticism for the impact it may have on nontarget species and ecological functions in some systems, especially less-selective lethal control techniques (Bergstrom et al. 2014). Bergstrom et al. (2014) question the long-term efficacy and sociopolitical underpinnings of lethal control. Yet, while nonlethal controls and compensation for loss of domestic animals may work in some settings, they are not effective in all cases (e.g., Naughton-Treves et al. 2003; Boitani et al. 2010; Dickman et al. 2011), and many researchers recommend flexible and multifaceted management approaches for addressing wildlife conflicts (Madden 2004). Bergstrom et al. (2014, p. 131) propose that sound wildlife conflict management “emphasize[s] training livestock producers in methods of nonlethal control, with sparing use of lethal control by methods that are species specific, and cease all lethal control in federal wilderness areas and for the purpose of enhancing populations of common game species.” Wildlife conflict management should also be situation specific (Madden 2004; Olson 2013).

Wisconsin uses a situation-specific mixture of lethal and nonlethal control to manage conflict (WDNR 1999). According to the Wisconsin wolf management plan (WDNR 1999, section E.3.d., p. 26), wolves may only be euthanized “when: (1) there have been significant documented, confirmed losses at a site, (2) the producer has a signed depredation management plan for the property and follows abatement/husbandry recommendations, (3) the USDA-WS Depredation Specialist recommends euthanasia, and the WDNR approves. (4) Wolf-dog hybrids will be euthanized in any zone where they are captured at depredation sites.” The USDA-WS also uses a species-specific lethal control method (i.e., trapping) in Wisconsin and the Wisconsin wolf management plan states that, “Lethal controls would rarely be authorized on large blocks of public land in areas of primary wolf habitat” (WDNR 1999, p. 5).

An important factor leading to injunction of the use of lethal control for depredating wolves was the apparent lack of evidence demonstrating the importance of local tolerance in the maintenance and conservation of wolf populations (Defenders of Wildlife v. Norton; Humane Society of US v. Kempthorne), a factor that continues to be critically important in the debate over wolves (Bruskotter et al. 2013). We have provided evidence that inconsistent state management authority to kill depredating wolves, as a result of legal challenges, was concurrent with increases in wolf–human conflicts and negative attitudes toward wolves, and ultimately may have led to increases in illegal killing of wolves. Our results suggest that local support for wolf management is an important consideration for managers balancing public interests and the long-term health of wolf populations. Yet, due diligence in the implementation of lethal control is warranted, because wildlife are held in public trust and the government also has a responsibility to ensure sustainable wildlife populations. Furthermore, interactions with wildlife (positive and negative) must be recognized as part of our relationship with wildlife in human-dominated landscapes, because even the most effective control methods cannot eliminate all negative interactions with wildlife. In areas where wolf populations have recovered, empowering local people through participation in wolf management, including greater public input and capacity to manage negative interactions such as through landowner
permits may promote greater acceptance of wolves because conflict management is within their power, even though they may not choose to use it. On the other hand, it is also clear from the sociopolitical conflict over wolves that non-consumptive wildlife users would like to participate in the management and conservation of wildlife, yet most wildlife management agencies are predominantly funded by fees paid by consumptive users. Empowering nonconsumptive users by providing more opportunities to participate in, and fund, wildlife management programs may lead to greater compromise at local and regional levels. This is critically important because nonconsumptive user groups have been primarily responsible for lawsuits challenging the reclassification and delisting of wolves. We urge state wildlife management agencies to explore opportunities for meaningful participation of consumptive and nonconsumptive users.

In Wisconsin, the legislature dictated aspects of the wolf hunt outside of the traditional administrative rule-making process. This led to the inclusion of a number of controversial methods and harvest regulations that caused concern amongst stakeholders and spurred both state and federal litigation. We suggest that state legislators avoid prescriptive hunting legislation and instead support conflict resolution initiatives between divergent stakeholder groups or risk further perpetuating the pendulum. Because the adequacy of existing regulatory mechanisms is one of the criteria for delisting, if state regulations are seen as too permissive of wolf hunting, wildlife advocates may have a stronger case to overturn delisting decisions (Doremus & Pagel 2001).

Many lessons have been learned from wolf recovery under the ESA. Looking forward, we suggest that a more step-wise approach could facilitate a smoother transition from the protections of the ESA to state management authority, such as, first reclassifying species as threatened prior to full delisting (e.g., wolves in Minnesota in 1978). Wolves in Wisconsin and across the eastern United States were reclassified to threatened in 2003; however, because the reclassification was applied too broadly over areas where wolves had not recovered, it was overturned (Refsnider 2009). Once species are reclassified as threatened, federal protections are scaled back and states have increased management flexibility for lethal control via special regulations under Section 4(d) of the ESA (USFWS 2013). To facilitate such a step-wise process, reclassification (endangered–threatened) should be efficient and expedited, especially in cases where a species population and distribution exceed reclassification goals. While some species have been successfully delisted using a step-wise process (~25%; e.g., bald eagles Haliaeetus leucocephalus in the lower 48), a majority (~75%) of species deemed recovered, excluding the gray wolf, went straight from endangered to delisted (~72% of animals; ~55% of species delisted since 2000; USFWS 2014). A step-wise strategy would reduce the seemingly binary nature of the ESA and promote the use of this intermediate, transitional stage (threatened) in the listing process. Although major changes to the delisting process would require statutory change to ESA, we encourage USFWS to work within its discretion to facilitate management along a gradient of protection as populations recover. If the wolf had first been successfully reclassified as threatened, legal challenges to subsequent delisting efforts would have reverted the species to threatened status (not endangered), providing more consistent management authority for states during the transition from federal to state authority and possibly minimizing the consequences of the multiple swings between endangered and delisted.

Conclusions

We demonstrate that swings in wolf status led to inconsistent management authority, declining local support for wolves, and possibly the unintended backlash of more illegal kills and a legislatively mandated wolf hunt. To our knowledge, we are the first to demonstrate a link between illegal wildlife killing and management authority under the ESA. This suggests that consistent and responsible depredation management programs may reduce illegal killing.

Federal protections under the ESA have been important to the recovery of wolf populations, such as in Wisconsin. But greater flexibility in the reclassification process could have allowed for a smoother transition from federal to state management authority. We encourage USFWS to move toward a step-wise process for delisting. However, to avoid unnecessary delay and to promote the use of this step-wise process USFWS should develop a more efficient and expedited reclassification process (endangered to threatened) for species surpassing recovery criteria. Once a species is delisted, states, as trustees of wildlife, need to consider local perceptions of wildlife and should avoid actions that may call into question the state’s commitment to the conservation of a species. Both state and federal governments should seek ways to empower nonconsumptive users by providing more opportunities to participate in, and fund wildlife management programs, and nongovernmental organizations should be cognizant of the potential consequences of successful litigation as described herein.
Acknowledgments

We thank USDA-WS wildlife specialists who investigated wolf depredations, the WDNR volunteer trackers, and J. Wiedenhoeft. We thank J. Owley, M. Schwartz, S. Ventura D. Waller, and three anonymous reviewers for providing a thorough review of this manuscript. This research was funded, in part, through a NSF-IGERT CHANGE Fellowship awarded to ERO.

References

Bergstrom, B.J., Arias, L.C., Davidson, A.D., Ferguson, A.W., Randa, L.A., & Sheffield, S.R. (2014). License to kill: Reforming federal wildlife control to restore biodiversity and ecosystem function. Conserv. Lett., 7, 131-142.

Boitani, L., Ciucci, P. & Raganelle-Pelliccion, E. (2010). Ex-post compensation payments for wolf predation on livestock in Italy: a tool for conservation? Wildl. Res., 37, 722-730.

Brown-Nunez, C., Treves, A. & MacFarland, D. (2012). Influence of official lethal control on illegal take, social tolerance, and subsequent depredations? The case of Wisconsin gray wolves (Canis lupus). A Report of Findings. http://www.nelson.wisc.edu/people/treves/wolves/wollhuman.php (visited Aug. 5, 2012).

Bruskotter, J.T., Vucetich, J.A., Enzler, S., Treves, A. & Nelson, M.P. (2013). Removing protections for wolves and the future of the U.S. Endangered Species Act (1973). Conserv. Lett., 7, 401-407.

Dickman, A.J., Macdonald, E.A. & Macdonald, D.W. (2011). A review of financial instruments to pay for predator conservation and encourage human-carnivore coexistence. PNAS, 108, 13937-13944.

Doremus, H. & Pagel, J.E. (2001). Why listing may be forever: perspectives on delisting under the U.S. Endangered Species Act. Conserv. Biol., 15, 1258-1268.

Dorrance, M.J. (1983). A philosophy of problem wildlife management. Wildl. Soc. Bull., 11, 319-324.

Fishbein, M., & Ajzen, I. (2010). Predicting and changing behavior: the reasoned action approach. Psychology Press, Taylor & Francis Group, New York, NY, USA.

Goldman, M.J., de Pinho, J.R. & Perry, J. (2013). Beyond ritual and economics: Maasai lion hunting and conservation politics. Oryx, 47, 490-500.

Gray, B. (2004). Strong opposition: frame-based resistance to collaboration. J. Community Appl. Soc. Psychol., 14, 166-176.

Haight, R.G., Travis, L.T., Nimerfro, K., & Mech, L.D. (2002). Computer simulation of wolf-removal strategies for animal damage control. Wildl. Soc. Bull., 30, 844-842.

Harper, E.K., Paul, W.J. & Mech, L.D. (2005). Causes of wolf depredation increase Minnesota from 1979–1998. Wildl. Soc. Bull., 33, 888-896.

Kaltenborn, B.P., Bjerke, T., Nyahongo, J.W. & Williams, D.R. (2006). Animal preferences and acceptability of wildlife management actions around Serengeti National Park, Tanzania. Biodiv. Conserv., 15, 4633-4649.

Madden, F. (2004). Creating coexistence between humans and wildlife: global perspectives on local efforts to address human-wildlife conflict. Hum. Dimens. Wildl., 9, 247-257.

McManus, J.S., Dickman, A.J., Gaynor, D., Smuts, D.H. & MacDonald, D.W. (2014). Dead or alive? Comparing costs and benefits of lethal and non-lethal human-wildlife conflict mitigation on livestock farms. Oryx, doi:10.1017/S0030605313001610.

Mech, D. (2010). Considerations for developing wolf harvesting regulations in the contiguous United States. J. Wildl. Manage. 74, 1421-1424.

Messmer, T.A., Reiter, D. & West, B.C. (2001). Enhancing wildlife sciences’ linkage to public policy: lessons from the predator-control pendulum. Wildl. Soc. Bull., 29, 1253-1259.

Mladenoff, D.J., Clayton, M.K., Pratt, S.D., Sicklely, T.A. & Wydeven, A.P. (2009). Change in occupied wolf habitat in the Northern Great Lakes region. Pages 119–138 in A. P. Wydeven, T. R. Van Deelen & E. J. Heske, editors. Recovery of gray wolves in the Great Lakes region of the United States: an endangered species success story. Springer, New York, USA.

Naughton-Treves, L., Grossberg, R. & Treves, A. (2003). Paying for tolerance: rural citizen’s attitudes toward wolf depredation and compensation. Conserv. Biol., 17, 1500-1511.

Nic, M.A. (2002). Wolf recovery and management as value-based political conflict. Ethics Place Environ., 5, 65-71.

Nic, M.A. (2003). Drivers of natural resource-based political conflict. Policy Sci., 36, 307-341.

Olson, E.R. (2013). As a wolf: A Wisconsin case-study of wolf-human conflicts and predator-prey ecology. Doctoral Dissertation. University of Wisconsin–Madison Library, Madison, WI, USA.

Rinfret, S.R. (2011). Behind the shadows: interests, influence, and the U.S. Fish and Wildlife Service. Human Dimens. Wildl., 16, 1-14.

Relsnider, R.L. (2009). The role of the Endangered Species Act in Midwest wolf recovery. Pages 311-338 in A.P. Wydeven, T.R. Van Deelen & E.J. Heske, editors. Recovery of gray wolves in the Great Lakes region of the United States: an endangered species success story. Springer, New York, USA.

Reiter, D.K., Brunson, M.W. & Schmidt, R.H. (1999). Public attitudes toward wildlife damage management and policy. Wildl. Soc. Bull., 27, 746-758.

Shelley, V., Treves, A. & Naughton, L. (2011). Attitudes to wolves and wolf policy among Ojibwe tribal members and non-tribal residents of Wisconsin’s wolf range. Human Dimens. Wildl., 16, 397-413.

Stenglein, J.L. (2014). Survival of Wisconsin’s gray wolves from endangered to harvested, 1980–2013. Doctoral Dissertation. University of Wisconsin – Madison Library, Madison, WI, USA.
Pendulum swings in wolf management

Treves, A., Naughton-Treves, L. & Shelley, V. (2013). Longitudinal analysis of attitudes toward wolves. *Conserv. Biol.*, 27, 315–323.

[USDA-WS, USFWS & WDNR] United States Department of Agriculture Wildlife Services, United States Fish and Wildlife Service, & Wisconsin Department of Natural Resources. (2006). Final environmental assessment for the management of wolf conflicts and depredating wolves in Wisconsin. Sun Prairie, WI, USA.

[USFWS] United States Fish and Wildlife Service. (2013). Gray Wolves in the Western Great Lakes States. http://www.fws.gov/midwest/wolf/ (visited Feb. 2013).

[USFWS] United States Fish and Wildlife Service. (2014). Environmental Conservation Online System: Threatened & Endangered Species. http://ecos.fws.gov/ecos/home.action (visited Jun. 2014).

Vaske, J.J., Roemer, J.M. & Taylor, J.G. (2013). Situational and emotional influences on the acceptability of wolf management actions in the Greater Yellowstone Ecosystem. *Wildl. Soc. Bull.*, 37, 122–128.

[WDNR] Wisconsin Department of Natural Resources. (1999). Wisconsin Wolf Management Plan. WDNR PUBL-ER-099 99. Madison, WI, USA.

Wydeven, A.P., Wiedenhoeft, J.E., Schultz, R.N. *et al.* (2011). Wisconsin Endangered Resources Report #140 Status of the Timber Wolf in Wisconsin Performance Report 1 July 2010 through 30 June 2011. WDNR, Madison, WI, USA.

Wydeven, A.P., Wiedenhoeft, J.E., Schultz, R.N., Bruner, J. & Boles, S.R. (2012). Wisconsin Endangered Resources Report #141 Status of the Timber Wolf in Wisconsin Performance Report 1 July 2011 through 30 June 2012. WDNR, Madison, WI, USA.

Wydeven, A.P., Van Deelen, T. R. & Heske, E.J. (2009). Recovery of gray wolves in the Great Lakes region of the United States: an endangered species success story. Springer, New York, NY, USA.

Zinn, H.C., Manfredo, M.J., Vaske, J.J. & Wittman, K. (1998). Using normative beliefs to determine the acceptability of wildlife management actions. *Soc. Nat. Resour.*, 11, 649-662.