A review of fact claims about liberalizing the killing of wolves

Abstract

Predators play important, disproportionate roles in ecosystem health. Nevertheless, several governments recently initiated killing wolves non-selectively and in large numbers. Among the justifications, four fact claims are made for widespread wolf-killing: (1) increasing human safety, (2) raising human tolerance for surviving wolves, (3) preventing livestock loss, and (4) increasing wild ungulate populations. We reviewed the research into these claims and found scant evidence to support or refute claim (1). We found evidence to suggest equivocal or no effects of wolf-killing on the other three claims, or that killing wolves likely led to counter-productive outcomes. We also summarized reported benefits associated with wolves. We proposed several hypotheses to explain the use of unsupported claims and to explain expansion of wolf-killing recently. The three, non-mutually exclusive hypotheses for unsupported fact claims refer to trusted messengers are unreliable, misinterpreting scientific uncertainty, and interest group politics. Finally, we summarize explanations for the politics behind wolf-killing itself and the potential harms of unsupported claims on democratic processes.

Introduction

Worldwide consensus among ecologists provides strong evidence that top predators play important and disproportionate roles in ecosystem diversity and function (Estes et al. 2011). Nevertheless, in 2021 some state governments began pursuing aggressive efforts to reduce wolf populations through programs that include liberalized hunting, trapping, and hounding seasons, and efforts to incentivize killing (e.g.,
bounties). For example, Wisconsin reduced its wolf population by more than 27-33% in <1 year and then proposed a second wolf-hunt in the same year (Treves et al. 2021b; Treves & Louchouarn 2022); Idaho, Montana, and Wyoming planned to reduce their wolf populations by 90% or more (Brown & Samuels 2021).

These efforts represent a departure from policies of the recent past (Brown 2008) and (Bruskotter et al. 2010; Bruskotter et al. 2011), and raise the question: why are states killing so many wolves? Herein, we address justifications based on four fact claims that are commonly provided for permitting or encouraging an increase in the legal killing of wolves and other large carnivores: (1) increasing human safety, (2) raising human tolerance for surviving wolves, (3) preventing livestock loss, and (4) increasing wild ungulate populations. We evaluate the fact claims (hereafter ‘claims’) by reviewing the science on the social and ecological effects of these policies.

**Increasing human safety**

Wolves can, and in rare circumstances do, attack people (Linnell & Bjerke 2002; McNay 2002; Linnell et al. 2021). Thus, one justification governments provide for killing wolves has been to increase human safety. In Supplementary Materials 1, we present reports and statements by officials from the States of Michigan, Idaho, and Montana that show how claims about human safety have been used to raise fears or justify wolf-killing programs. Despite such warnings, zero humans have been killed by wolves in the Northern Rockies since their reintroduction.

In fact, wolves pose so little risk to people that aggressive killing programs proposed by U.S. states cannot lead to any further meaningful reduction of risk. Linnell and colleagues
(2002,2021) compiled documented reports of wolf attack on humans. The more recent study found evidence of 489 human victims of wolf attacks spanning 2002 to 2020 across the world, 26 of which were fatal, plus an equal number that were either too poorly documented to verify or “clearly” not caused by wolves, e.g., by dogs. Rabies explained 77% of the above attacks and 59% of fatalities, and the geographic distribution of attacks correlated with rabies incidence across Eurasia. These researchers classified 14% of attacks as “predatory,” which accounted for 36% of the fatalities. The remaining attacks were classified as “provoked/defensive”. They concluded, “In Europe and North America we only found evidence for 12 attacks (with 14 victims), of which 2 (both in North America) were fatal, across a period of 18 years. Considering that there are close to 60,000 wolves in North America and 15,000 in Europe, all sharing space with hundreds of millions of people it is apparent that the risks associated with a wolf attack are above zero, but far too low to calculate.” Abstract, (Linnell et al. 2021).

Given the recovery of many wild prey populations eaten by wolves and wider acknowledgment of the problem associated with supplemental feeding of wild carnivores, the conditions for wolf attacks on people have accordingly diminished. Indeed, predatory attacks on people “…have been associated with a special set of environmental circumstances (absence of wild prey, heavily modified landscapes, high density of humans engaged in vulnerable activities) that are no longer present…” (Linnell & Alleau 2016) and consequently, “the risks of wolf attacks are currently very low” …” (Linnell & Alleau 2016).

Occasionally, wolf attacks may be precipitated by incidents of accidental or purposeful conditioning of wild wolves, whereby wolves learn to associate humans with food
or lose fear of people via habituation (McNay 2002). However, there is simply no evidence
that such behavior is as widespread as it may have been before the 20th century (Linnell &
Bjerke 2002).

Increasing human tolerance for wolves

Governments often claim that killing wolves increases public tolerance (or decreases
intolerance) for wolves and their conservation (Refsnider 2009; Bruskotter et al. 2013;
Treves & Bruskotter 2014; Chapron & Treves 2017b; Epstein et al. 2019). Yet, existing
scientific evidence indicates that programs that liberalize the killing of wolves generally have
not improved tolerance for wolves (Treves & Bruskotter 2014). The best evidence comes
from the state of Wisconsin, where researchers assessed human attitudes using long-term,
repeated measures (same individuals) before and after policy changes that liberalized wolf-
killing or conversely, tightened protections for wolves. In total, three independent studies
come from Wisconsin and Montana, (Supplementary Material 2).

Neither the Wisconsin nor Montana studies provide support for policies that seek to
raise tolerance by expanding wolf-killing; but why? Policies may fail to affect tolerance if
they are perceived by those who are intolerant as insufficient for reducing the risks they
associate with wolves, or there may be a lag between the time the policy is enacted and
subsequent changes in tolerance. The Wisconsin study shows a 12-year lag during which
time tolerance declined in the face of such policies. These factors could explain both the
growing intolerance witnessed in Wisconsin and the lack of change witnessed in the 2012
and 2018 studies in Montana.
A second way to examine the effect of policy on tolerance is to examine tolerance within a society across regions with different policies. To that end, Kaczensky et al. (Kaczensky et al. 2004) compared attitudes toward brown bears in two regions of Slovenia with different policies and bear damage levels. They found no difference in attitudes toward bears across regions. Similarly, Bruskotter et al. (2018) found no differences in attitudes towards wolves across three regions of the U.S. with different wolf management policies and histories (Bruskotter et al. 2018). Though a follow-up study found lower levels of tolerance in areas with wolves among certain sub-groups (i.e., hunters, ranchers; Carlson et al. 2020).

These studies are generally consistent with the longitudinal research explored above in so much as both suggest that policy changes have little effect on attitudes.

Beyond the effect of policy, researchers have proposed a variety of mechanisms of attitude change both at the individual and societal level. e.g., (Ericsson et al. 2007; Karlsson & Sjöström 2007; Heberlein & Ericsson 2008; Bruskotter et al. 2017). A full review of these mechanisms is beyond the scope of this essay. However, a few findings are worth summarizing: (i) At the societal level, evidence indicates that the U.S. public at large has become substantially more positive towards wolves over the past half-century (George et al. 2016; Slagle et al. 2017); (ii) tolerance is strongly associated with changing social conditions (e.g., increased urbanization, education, income) that are often currently beneficial to carnivore conservation (Bruskotter et al. 2017; Manfredo et al. 2019; Manfredo et al. 2020; Manfredo et al. 2021). While these findings raise intriguing hypotheses, experimental studies, e.g., (Slagle et al. 2013) would be useful to better understand causal mechanisms.
Collectively, existing evidence indicates that tolerance is unaffected by management policies.

Beyond attitudes, some studies have assessed the effects of liberalized killing policies on tolerance more directly by examining hazard and incidence rates of poaching (illegal killing of wolves). Three populations of wolves showed substantial slow-downs in wolf population growth independent of the number of wolves killed legally each time wolf-killing was liberalized (Chapron & Treves 2016a, b, 2017a, b; Louchouarn et al. 2021). Slower population growth was inferred to reflect a hidden cause of mortality, poaching. Thus, some proportion of wolves killed illegally is observed directly, while another portion is observed indirectly, called “cryptic poaching” (Liberg et al. 2012). Failure to account for cryptic poaching – for example, discarding information on missing radio-collared wolves can have the effect of obscuring the dynamics of poaching and biasing population models (Treves et al. 2017; Santiago-Ávila et al. 2020b; Agan et al. 2021; Santiago-Ávila & Treves 2022).

Recent measurements of hazards and incidences of different endpoints for radio-collared wolves (i.e., death or disappearance) in gray wolves of Wisconsin and also the Mexican gray wolf subspecies in Arizona and New Mexico, reveal patterns of human poaching behavior also (Santiago-Ávila et al. 2020a; Louchouarn et al. 2021; Santiago-Ávila & Treves 2022); this research has been replicated in two additional populations (Michigan gray wolves and North Carolina red wolves), which are under review. Taken altogether, the ratio of reported poaching to cryptic poaching, and the sum of all poaching seems to vary with policy on hunting bears, deer, and coyotes; federal policy on wolf protection; and methods of censusing wolves. Although a detailed description of the previous work on
hazard and incidence of poaching for collared wolves is beyond our scope here, the
inference for our present context is clear. Liberalizing wolf-killing did not raise tolerance
when tolerance was measured in terms of poaching rates. Moreover, the latest studies
follow new Open Science rules for registered reports that reduce publication biases
(Sanders et al. 2017). That makes these studies the best available science by the standards
of evidence accepted by the global scientific community.

The only credible peer-reviewed research suggesting poaching declined when legal
wolf-killing was liberalized comes from Nordic countries (Suutarinen & Kojola 2017;
Suutarinen & Kojola 2018; Liberg et al. 2020). However, the Scandinavian study has been
questioned on statistical grounds of inappropriate survival analyses and inappropriate
model specifications (Treves et al. 2020). It also did not account for non-breeding wolves
nor for the finding from neighboring Finland that the more legal killing occurred, the lower
the risk of poaching because wolves were removed legally before they could be removed
illegally (Suutarinen & Kojola 2017; Suutarinen & Kojola 2018). Moreover, as Santiago-Ávila
and Louchouarn pointed out, when the government preemptively removes wolves
suspected of problems before they can be killed illegally, it’s difficult to claim humans are
exhibiting greater tolerance (Santiago-Ávila et al. 2020a; Louchouarn et al. 2021).

Collectively, studies support the hypothesis that governments send a signal to
would-be poachers that wolves are low in value, or that the government needs the support
of poachers to control wolf populations (Chapron & Treves 2016a). For example, Idaho
recently contributed to funds to pay bounties for dead wolves
(https://www.kmvt.com/2021/10/14/idaho-fish-game-reimburse-hunters-wolf-kills/) and in
years past, the same agency defied federal regulations protecting wolves by announcing
that they would no longer allow their own personnel to investigate reports of wolf poaching
https://www.spokesman.com/stories/2010/oct/19/idaho-pulling-back-on-wolves/. Thus,
we predict these policies have led and will continue to lower tolerance for wolves and
increase wolf killing.

Killing wolves to prevent domestic animal losses

One of the long-standing reasons for humans to kill wolves and other threatening
animals was to protect domestic animals, especially before secure fencing or structures
could separate them from wild animals (Treves & Bonacic 2016). For example, the U.S.
Department of Agriculture’s Wildlife Services division was created largely to kill offending
animals (Robinson 2005; USDA APHIS 2015), and local jurisdictions also do this in many
countries (Bjorge & Gunson 1983; Fritts et al. 1992; Musiani et al. 2005; Epstein & Chapron
2018; Darpö 2020).

In the case of livestock protection, the best available evidence would come from
before-and-after comparisons of interventions with random sampling (Khorozyan 2021) and
other safeguards against research bias (Treves et al. 2016; Treves et al. 2019). No such
studies exist for wolf-killing. To date, research on lethal management of wolves ranges from
before-and-after comparisons without randomization to lower standard, correlational
analyses that leave numerous potentially confounding variables uncontrolled, e.g., (Krofel

Taken together, compiled research on the subject provides contradictory
conclusions. Lethal management of wolves can in some cases reduce risk and in others raise
risk or have no effect at all. Note that although Bradley et al. (Bradley et al. 2015) claimed that lethal removal of an entire wolf pack would reduce livestock losses in that territory thereafter, Santiago-Avila et al. (Santiago-Avila et al. 2018) were unable to reproduce their methods let alone their results even after corresponding with the two lead authors.

Replicating the methods with improved transparency and sharing all the data for Michigan’s wolf control program, Santiago-Avila (Santiago-Avila et al. 2018) found risk increased for cattle in neighboring townships after one or more wolves were killed at a nearby farm within approximately 18 km. Therefore, the most rigorous research to date found that targeted wolf-killing in Michigan, USA and wolf range, France (Santiago-Avila et al. 2018; Grente 2021) did not increase livestock safety. In a minority of cases, wolf-killing appeared effective for preventing recurrent livestock killing, but an equal or greater number of cases appear to show an increase in livestock killing after lethal management.

In the latter studies and every review thus far published on the effectiveness of lethal methods as a way to protect livestock, authors from over a dozen countries report occasional counter-productive effects resulting in higher livestock losses after predator-killing (Miller et al. 2016; Eklund et al. 2017; Lennox et al. 2018; Moreira-Arce et al. 2018; van Eeden et al. 2018a; van Eeden et al. 2018b; Khorozyan & Waltert 2019; Treves et al. 2019; Khorozyan & Waltert 2020). Moreover, the effectiveness of non-lethal methods and the standards of evidence used for their study are consistently higher than for lethal methods (Supplementary Material 3).

Preventative, non-lethal methods are generally preferable over post hoc killing of predators to avoid losses in the first place, and avoid government reimbursements (thus
potentially saving money and time). Payments for wolf damage have not been associated with higher tolerance for wolves (Montag et al. 2003; Naughton-Treves et al. 2003; Treves et al. 2009) and seem plagued by problems of accuracy or inequity (Agarwala et al. 2010; López-Bao et al. 2017; Plumer et al. 2018). In general compensation payments can lead to a decline in protective husbandry, which may distract from the more hazardous causes of livestock mortality from disease, weather, and accidents (Allen & Sparkes 2001; Linnell & Broseth 2003; Wallach et al. 2017).

Non-lethal methods have rarely led to counter-productive increases in livestock losses due to wolves. For example, the non-lethal method (Foxlights®) has twice been associated with increases in predation by carnivores other than wolves and so resulted in more livestock losses under particular circumstances, i.e., effective against pumas but not Andean foxes in Chile (Ohrens et al. 2019) and counter-productive against foxes in Australia (Hall & Fleming 2021). Also, sub-lethal methods such as translocation often result in higher mortality of the translocated wolves and perhaps recurrent livestock losses following such removals (Fritts et al. 1985).

Methods that remove wolves diminish the benefits of wolves and may disrupt social dynamics in ways that lead to additional livestock losses, thereby probably perpetuating a cycle of killing that can spread livestock losses geographically (Santiago-Avila et al. 2018; Grente 2021). Although eradication of all predators would, of course, protect livestock from predation (Breitenmoser 1998; Riley et al. 2004; Nilsen et al. 2007), less drastic killing can produce variable and unpredictable results. For example, lethal management that left survivors of the same species in a majority of cases resulted in the same amount or higher
livestock losses as summarized above, as did lethal management that eliminated one carnivore but left another species of predator. Furthermore, removing carnivores can increase immigration of young animals into the area, which may result in higher levels of predation on livestock (Peebles et al. 2013). Removing apex carnivores may also result in higher abundances of subordinate carnivores (Newby & Brown 1958; Crooks & Soulé 1999). Those and other mesopredator interactions suggest that eradications of large predators like the wolves will have varied effects on other animals including domestic ones (Krofel et al. 2007; Prugh et al. 2009; Allen et al. 2016; Minnie et al. 2016; Newsome et al. 2017; Nattrass et al. 2019; Elbroch et al. 2020). For example, the eradication of the Tasmanian thylacine *Thylacinus cynocephalus* seems to have left niche vacancies for the smaller dingoes (*Canis familiaris dingo*) and red foxes (*Vulpes vulpes*) to become the dominant livestock predators of Australia and Tasmania (Greentree et al. 2000; Allen & Sparkes 2001; Sillero-Zubiri et al. 2007; Newsome et al. 2017). Or consider the expansion of range by coyotes *Canis latrans* in the wake of extermination of red (*C. rufus*) and gray wolves (*C. lupus*) across many U.S. States and Canadian provinces (Gompper 2002; Hinton et al. 2016), with associated complaints of losses from sheep owners, for example (Murray Berger 2006).

The counter-productive increases in property damage or losses of game after lethal management have been reported anecdotally for over half a century (Newby & Brown 1958; Haber 1996). Such anecdotes have been corroborated by systematic scientific studies of coyote-killing. Virtually all (99%) of the predation by coyotes on sheep was done by mated pairs with pups to feed, so most lethal management kills coyotes that have not killed and will not kill sheep (Knowlton et al. 1999); also see (Wallach et al. 2017) for counter-
productive effects of killing dingoes on an Australian cattle ranch, and more recently by systematic scientific studies of wolf killing in several countries as summarized above. Given that societies globally have outlawed programs of eradication of native predators (Ripple et al. 2014; Ripple et al. 2017a; Ripple et al. 2017b), we conclude from the scientific evidence that non-lethal methods have a better record both in terms of effectiveness and higher standards of scientific research (Treves et al. 2019). Non-lethal methods will also safeguard the diverse benefits of wolves we summarize below.

**Killing wolves to increase wild ungulate abundance**

Relatedly, governments have for a century or more justified killing wolves as a means to increase hunting opportunity for ungulates, such as elk and deer (Leopold 1933 reprinted 1986, 1949; Theberge & Gauthier 1985) (Harbo & Dean 1983). Wolves are capable of reducing wild ungulate populations (Ripple & Beschta 2012); however the effect of wolves on ungulates depends on other factors, such as ungulate vulnerability driven by winter severity (Vucetich & Peterson 2009; Peterson et al. 2014), local primary productivity (Melis et al. 2009), the abundance of local ungulates relative to their carrying capacity (Ballard et al. 2001), the diversity of the local carnivore guild and potential for multiple ungulate predators (Griffin et al. 2011) and the abundance of alternative prey (i.e. apparent competition; Wittmer et al. 2005). A rigorous, recent meta-analysis of the outcomes of carnivore removal on ungulate populations determined that predator removals resulted in increased juvenile survival and recruitment, but equivocal effects on ungulate abundance, which should be the metric that determines success (Clark & Hebblewhite 2021). In a meta-analysis of female elk
survival from western North America, (Brodie et al. 2013) concluded that the best way to
decrease human harvest rather than
predators.

The exceptions to these general patterns are predator effects on small ungulate
populations. Wolf predation can harm rare ungulates via apparent competition.
However, the underlying circumstances that lead to apparent competition are generally
created by anthropogenic influences on ecosystems. Even intensive wolf-killing may not
affect such rare ungulates, e.g. endangered woodland caribou; (Wittmer et al. 2005). For
example, (Hervieux et al. 2014) found killing 841 wolves over 7 years, which equated to a
45% reduction in mid-winter wolf abundance, was insufficient to increase the population
growth rate of endangered woodland caribou in their study area.

Reports from all U.S. states with wolf populations indicate that opportunities to
hunt wild ungulates have not been diminished by increased wolf populations. Indeed,
recent records from Idaho, Montana, and Wyoming indicate that the number of elk
killed by hunters in recent years is stable to increasing in those three states, as are elk
populations. Data from Idaho, Montana and Wyoming were summarized here:
https://extension.colostate.edu/topic-areas/people-predators/wolves-big-game-and-
hunting-8-001/. In Wisconsin, the forty-five-year period from 1975-2020, the state deer
population grew from 600,000 to 1.61 million
(https://www.researchgate.net/figure/Wisconsin-Prehunt-and-Posthunt-Deer-
Population-Estimates-and-Goal-1960-2010-Source_fig5_324135601), while the wolf
population grew from zero to 1034 in late winter counts (Wiedenhoeft et al. 2020). Also,
hunters took 200,000 deer in the 1980s as compared to 500-600,000 in the 2000s

Collectively, these data and the scientific studies suggest that the positive effects of killing wolves on wild ungulate abundance are negligible.

A mismatch between goals of wolf-killing and approaches taken

The above four claims can also be viewed as the objectives for liberalized killing of wolves. Objectives 1 and 3 (increasing human safety, preventing livestock loss), and perhaps objective 2 as well (raising human tolerance for wolves) are driven by negative interactions with individual wolves or wolf packs, rather than populations of wolves. For this reason, the best strategy to mitigate the costs of these few wolves on human communities is their targeted removal rather than liberalized killing aimed at reducing the entire wolf population across wide areas. Should liberalized killing succeed in reducing the wolf population, but miss the wolves responsible for livestock loss or human safety concerns, the conflicts driving claims 1-3 are likely to continue unabated and calls for more killing may persist or escalate.

Hypothetically, liberalized killing to reduce the wolf population is a better match for the fourth objective, increasing ungulate populations and hunting opportunities at large scales. Nevertheless, reducing wolves to increase ungulate abundance rarely works for any but the smallest ungulate populations for the reasons we describe in the previous section, and because ungulate abundance is primarily explained by weather and primary productivity (White 2008), rather than apex carnivores.

The benefits and costs of coexistence between humans and wolves
Just public policy maximizes the benefits minus the costs associated with management interventions. Thus, having considered the various risks (i.e., to human safety, livestock, and wild ungulates), we find it appropriate to detail potential benefits. In general, research shows that majorities of people appreciate wolves and other carnivores, e.g., cougars, coyotes (Bruskotter et al. 2018; Manfredo et al. 2020), and that people report both financial and non-financial benefits of wildlife (Slagle et al. under review)(Kellert 1985; Williams et al. 2002; Naughton-Treves et al. 2003). One subpopulation of wolves in Yellowstone National Park, for example, has produced net financial benefits beyond the boundaries of the park (Duffield & Neher 1996; Duffield et al. 2008). Preliminary findings suggest that counties hosting one or more packs of wolves report fewer deer-vehicle collisions and reduced human injuries and fatalities, saving millions of dollars (Raynor et al. 2021). That result grew out of an awareness that wolves were changing the behavior of deer and elk and some evidence of broader ecosystem effects of wolves.

Many studies suggest wolves can also benefit ecosystems through their effects on their prey and associated ecological communities. For example, wolves may reduce the incidence or transmission of zoonotic and wildlife diseases (Wild et al. 2011; Tanner et al. 2019), increase scavenger diversity (Smith et al. 2003), and reduce deer damage to vegetation (Martin et al. 2020). Regarding the latter, rare understory plants fared better near the center of wolf pack territories (Callan et al. 2013), and forests were more biodiverse and mature, had higher tree volumes and regeneration rates, and resisted non-native plant invasions in the presence of wolves (Waller & Reo 2018). Though such effects may vary with conditions, research suggests wolves enhance biodiversity via direct and
indirect pathways that begin with limiting ungulate herbivory, or by altering the competition
between prey species. Scientific consensus holds that top predators generally play such roles
(Estes et al. 2011; LaBarge et al. 2022), but we would highlight the need for formal
comparisons between the benefits associated with apex carnivores and the economic costs
long attributed to wolves (Gilbert et al. 2021).

Lethal management of wolves is not cost-free, and so we need to weigh the use of
public funds for wolf killing against the benefits minus the costs of maintaining wolves, or
expanding their ranges. It is not at all clear that aggressive killing of wolves will significantly
reduce the real or perceived risks associated with living with wolves. Conversely, it is likely
that the large-scale killing of wolves as proposed by some governments will substantially
diminishing the benefits associated with their presence.

Why do governments cite weak or unsupported claims for aggressively killing wolves?

The scarcity of scientific evidence for the claims made to justify killing wolves leads
to an obvious question: why are governments making such claims? To begin with, three
non-exclusive explanations seem plausible.

1. Policy makers may believe their wolf-killing claims are true. For example, the
trusted messenger theory of communication sciences predicts that messages are believed
or embraced more quickly, and that they shape behavior more effectively when delivered
by a trusted messenger (Dunwoody 2007; Kinzig et al. 2013). Further, people tend to filter
information and retain what supports their existing belief and value systems (Kinzig et al.
2013; Bruskotter et al. 2016; Antonelli & Perrigo 2018; Byerly et al. 2018; Kinka & Young
2019). That propensity has led at times to predator management that conflates value-
based decisions with evidence-informed decisions (Mitchell et al. 2018; Koot et al. 2020; Treves et al. 2021a). If a trusted messenger delivers inaccurate information, policy-makers may find themselves weighing apparently contradictory science and then selecting that which they trust more based on the identity of the messengers or their inherent biases and beliefs on the subject. This hypothesis is partly dissatisfying because it leaves unanswered why the trusted messengers intentionally or unintentionally persuaded policy-makers with unsupported claims.

2. Policy-makers advancing wolf-killing with unsupported claims may not know the scientific evidence or may think the science is unclear enough to support their claims. We view this as unlikely because peer-reviewed scientific evidence has been presented repeatedly to debunk the claims via public comments, litigation, and official federal peer reviews, since 2013 (Bruskotter et al. 2013; Treves et al. 2021a). For example, the litigation and federal agency peer reviews have addressed some or all of the claims surrounding wolf protection and wolf-killing in Wisconsin, the northern Rocky Mountains, and nationwide (Naughton-Treves et al. 2003; Atkins 2019) and (Humane Society of the U.S. 2014, 2017, 1:13-cv-00186-BAH Doc 52, Western Watersheds Project 2018, 1:17-cv-00206-BLW Doc 22-3). Furthermore, the suggestion that scientific uncertainty about the four claims among scientists left policy with equivocal recommendations, has a prerequisite of transparent debate between experts with diverse views. We know of no such review or debate. In general, North American hunt management plans lack the hallmarks of independent review and transparency, as revealed by a close reading of 666 such plans and a survey of the agency staff responsible for carrying out such plans (Artelle et al. 2018a; Artelle et al.
Therefore, it seems implausible that policy-makers believed there was sufficient scientific uncertainty to support their claims.

3. Policy-makers may know their claims are unlikely to be true, and these policies instead reflect internal values or external pressures acting on policy decisions, e.g., (Chapron & Lopez-Bao 2014; Darimont et al. 2018). This possibility finds circumstantial support in several other claims made by current governments to justify wolf-killing. One such value-based claim is that hunters, trappers, and hound-hunters should be given additional hunting opportunities. The claim is that governments are creating more opportunities for these people via aggressive wolf policies. Although such justifications are not entirely in the domain of facts that scientists can evaluate, they are dubious on their face because of a logical flaw. Reducing carnivore abundance comes at the expense of carnivore hunters, who lose hunting opportunities over the long term (Mitchell et al. 2018).

Why then are governments promoting aggressive killing programs? Recent research documenting the relationship between voting for the reintroduction of wolves (a Colorado ballot measure in the 2020 election) and presidential voting may provide insights into the internal and external pressures that may be acting on policy makers and their constituents. That study found the strongest predictor of voting for wolf restoration at the precinct level was the proportion that voted for the Democratic candidate for president (Ditmer et al. 2022). Specifically, as Democratic voting increased, support for restoration increased ($\beta = 0.60$ to $0.66$ [95% CI]). Similarly, other research shows that political party affiliation and socio-political identity were strong predictors of attitudes toward carnivore policies in other jurisdictions (Hamilton et al. 2020; van Eeden et al. 2021) however, see (Carlson et al.
Collectively, these data suggest that the general issue of how to manage wolves has become politicized precisely at a time when the U.S. electorate is extremely polarized, politically (McCoy et al. 2018). In such environments, the wolf policies pursued by governments may not serve any legitimate wildlife management purpose. Rather, because wolf-killing policies align with the positions of interest groups that are themselves aligned with a conservative agenda (e.g., agricultural groups, hunting groups), and because these groups traditionally hold great sway with wildlife policy-making bodies, there is little risk for decision-makers in supporting such policies, e.g., (Chapron & Lopez-Bao 2014). In contrast, pursuit of policies viewed as supportive of wolves may carry substantial risk for policy-makers. Indeed, research from psychology has long shown how pressure to conform to group settings can powerfully influence decision-makers (Asch 1951; Asch 1952; Asch 1956). Moreover, the dynamics of multiple individual decision-makers acting in concert may complicate the policy analysis.

Regardless of the underlying causal explanation for why governments are using unsupported claims, the effect is corrosive on a constitutional democracy like that of the U.S., particularly one whose environmental assets are held in trust for current and future generations. Reliance on unlikely or false factual claims undermines both public policy and the authorities from which it emanates. As public trustees for wildlife under U.S. common law (Geer 1896, 161 U.S. 519, Hughes 1979, 441 U.S. 322, U.S. 1989, 710 F. Supp. 1286), elected and appointed government officials have a professional, legal, and ethical duty to account transparently with the most sophisticated methods for assets held in trust for current and future generations. Use of unlikely or false claims is undesirable for sound,
representative public policy and is therefore clearly undesirable for a constitutional democracy because such conduct would mislead the sovereign public.

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