Lethal management of large carnivores: Effects, side-effects, and gaps in knowledge

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Four common fact claims and the rarely stated benefits

1. Livestock protection
   - Scrutiny of Bradley et al. 2015
   - More reliable and more scientific studies of killing wolves

2. Raising public tolerance
   - Human attitudes
   - Human behavior

3. Protecting human safety

4. Protecting ungulate populations

Losing benefits for ecosystems and for people

Treves, A., J. T. Bruskotter, and L. M. Elbroch, 2024. Evaluating fact claims accompanying policies to liberalize the killing of wolves, peer-reviewed chapter TBA peer-reviewed chapter TBA In press. Alpha Wildlife Publications, Canada. https://faculty.nelson.wisc.edu/treves/pubs/Evaluate%20fact%20claims%20about%20killing%20wolves_2024.pdf

Common fact claim

Protect livestock?

- Scrutiny of Bradley et al. 2015
- More reliable and more scientific studies of killing wolves

Replication is the only way to be certain that a research finding is reliable.

The only way to replicate is to scrutinize and repeat the methods and try to repeat them.

A tragedy of errors

Mistakes in peer-reviewed papers are easy to find but hard to fix, report **David B. Allison** and colleagues.

Just how error-prone and self-correcting is science? We have spent the past 18 months getting a sense of that.

We are a group of researchers working on obesity, nutrition and energetics. In the summer of 2014, one of us (D.B.A.) read a research paper in a well-regarded journal estimating how a change in fast-food consumption would affect children's weight, and he noted that the analysis applied a mathematical model that over-estimated effects by more than tenfold. We and others submitted a letter[1] to the editor explaining the problem. Months later, we were gratified to learn that the authors had elected to retract their paper. In the face of popular articles proclaiming that science is stumbling, this episode was an affirmation that science is self-correcting.

Sadly, in our experience, the case is not representative. In the course of assembling weekly lists of articles in our field, we began noticing more peer-reviewed articles containing what we call substantial or invalidating errors. These involve factual mistakes or veer substantially from clearly accepted procedures in ways that, if corrected, might alter a paper's conclusions.

After attempting to address more than 25 of these errors with letters to authors or journals, and identifying at least a dozen more, we had to stop — the work took too much of our time. Our efforts revealed invalidating practices that occur repeatedly (see 'Three common errors') and showed how journals and authors react when faced with mistakes that need correction.

We learned that post-publication

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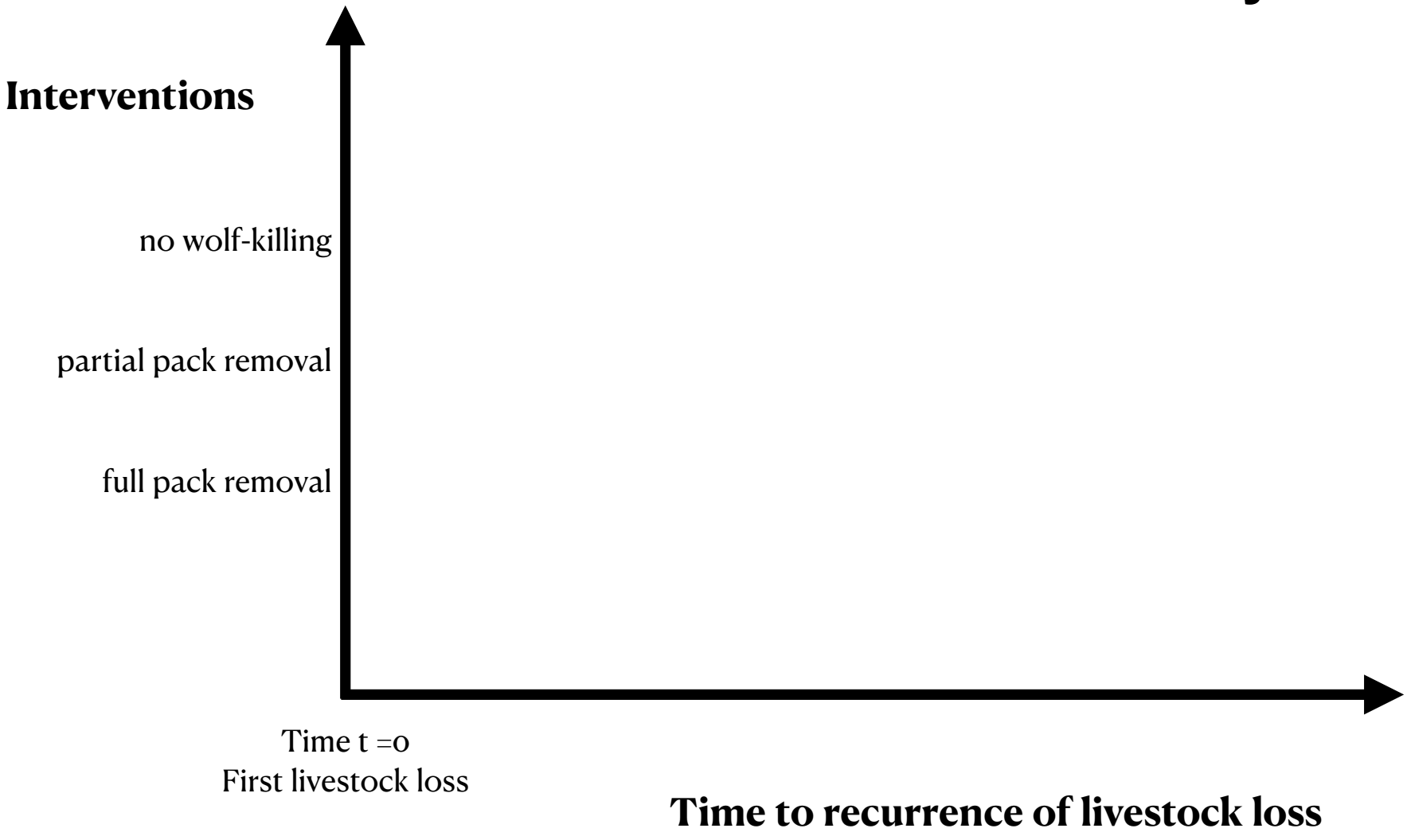
We tried to replicate the methods in Bradley et al. 2015 and discovered the following

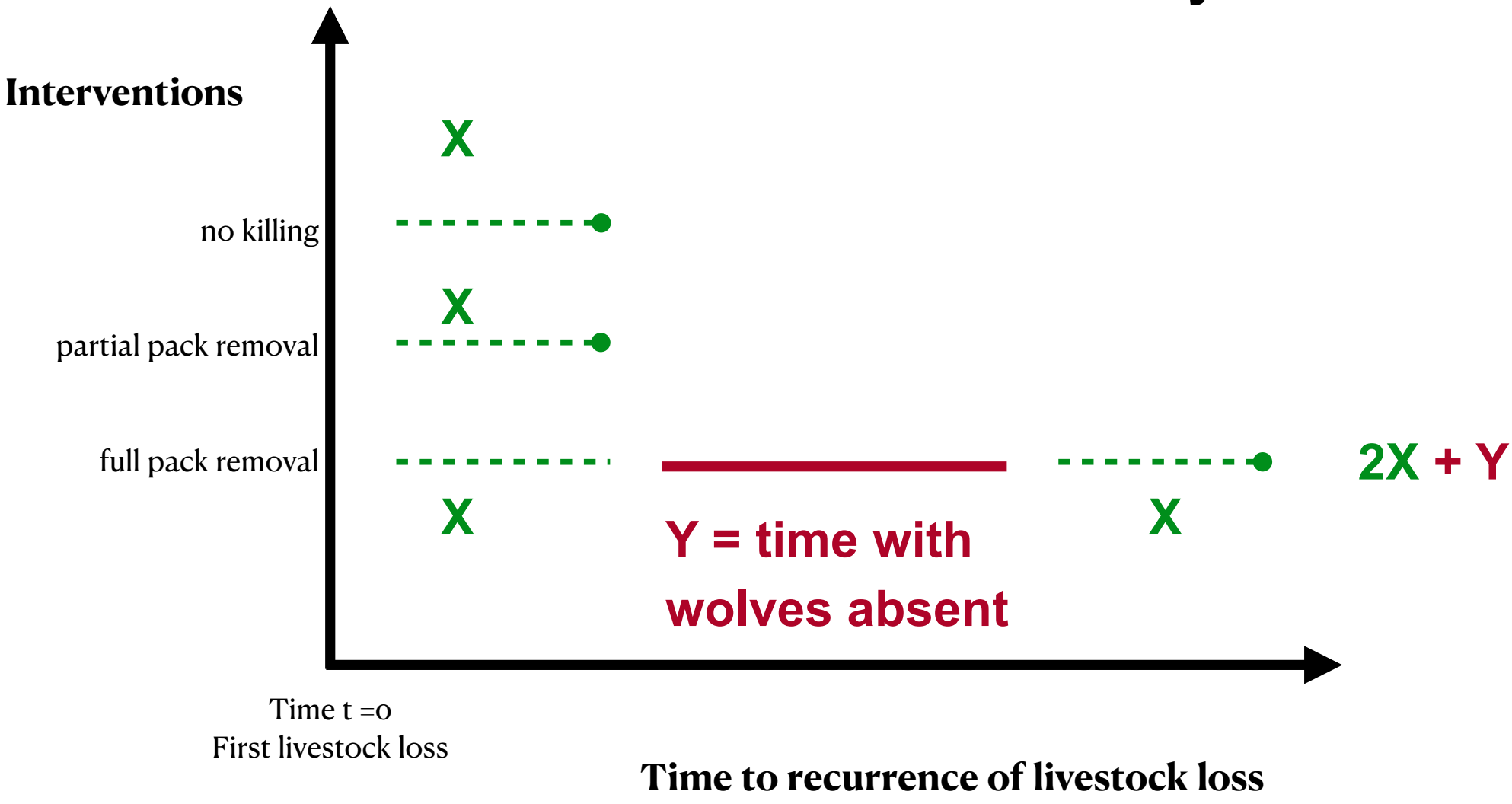
1. Data are secret (JWM was not. a signatory to COPE [2])
2. Methods are unclear and missing essential variables [3]
3. Inappropriate baseline comparison (no control for full pack removal) introduces a positive bias for lethal methods [3,4]

1.Bradley et al. 2015.. Journal of Wildlife Management 79: 1337–1346.
2.COPE = Committee on Publication Ethics https://publicationethics.org/ and Krausman 2022. The Journal of Wildlife Management 86: e22167.
3.Santiago-Avila et al. 2018.. PLoS One 13: e0189729
4.Allison et al. 2016. Nature 530: 27-29.

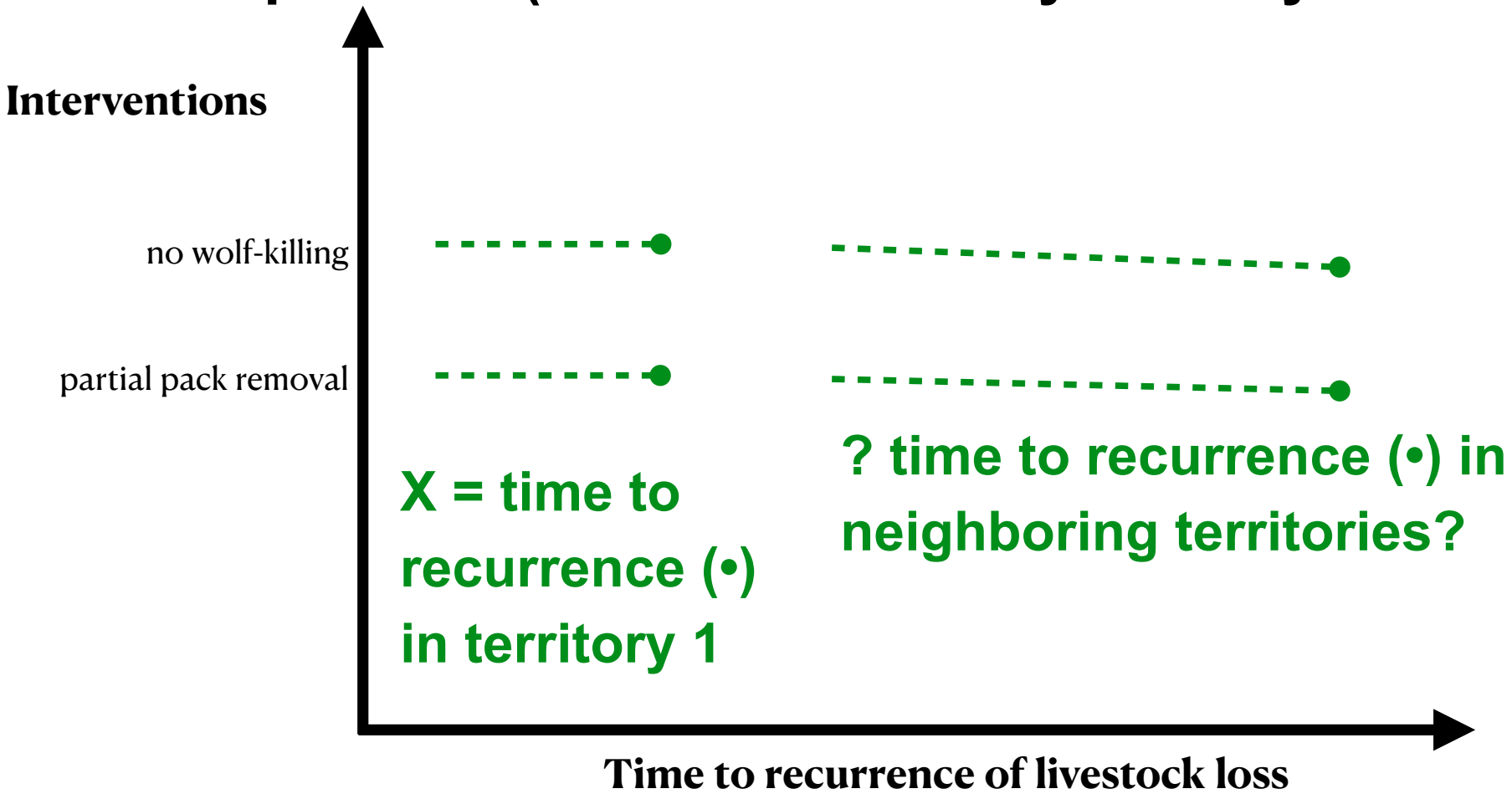
Methods in Bradley et al. 2015



Methods in Bradley et al. 2015

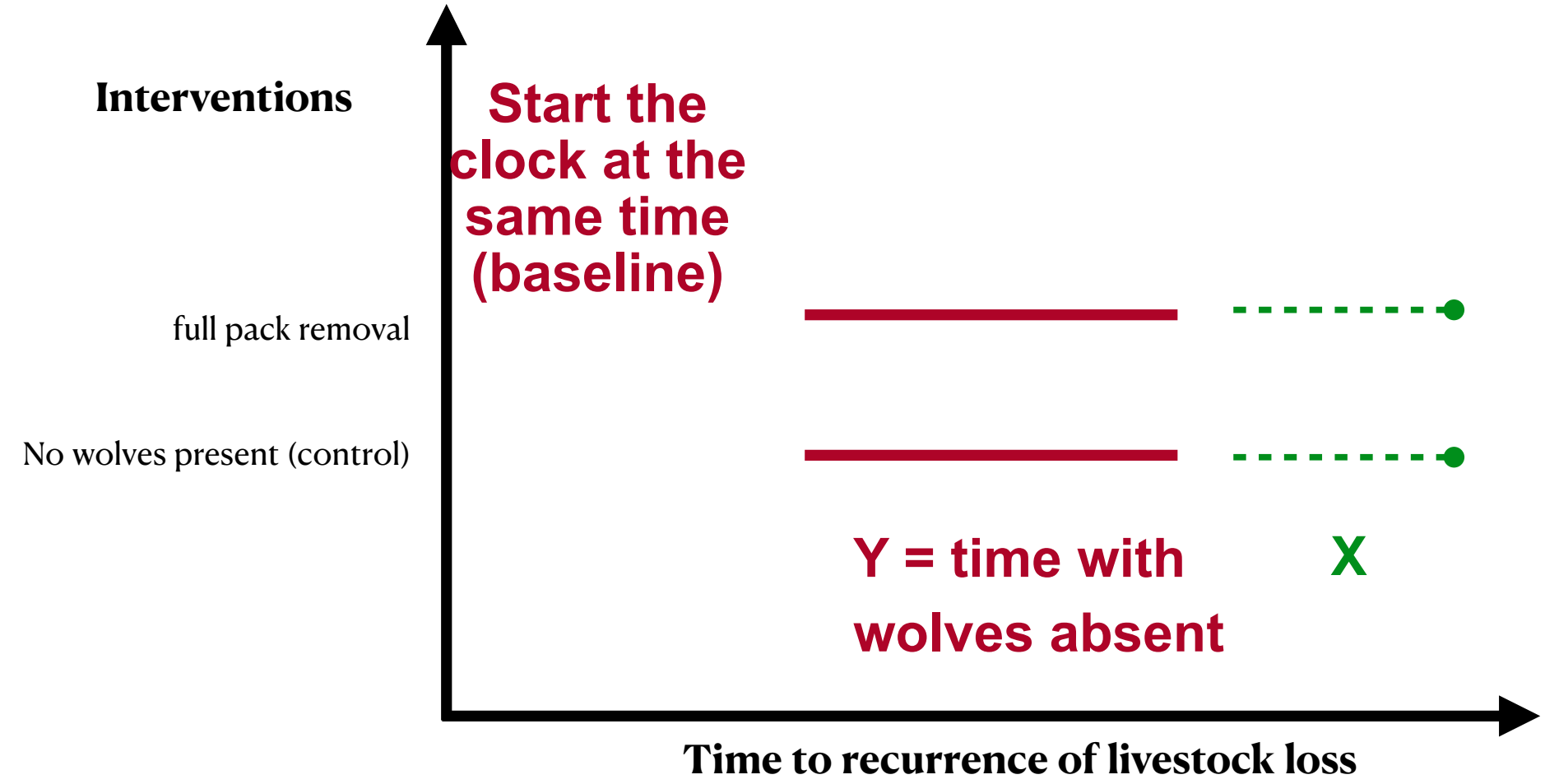


Spill-over (not considered by Bradley et al. 2015)



Santiago-Avila et al. 2018.. PLoS One 13: e0189729
Allison et al. 2016. Nature 530: 27-29.

Appropriate baseline (not used by Bradley et al. 2015)



Santiago-Avila et al. 2018.. PLoS One 13: e0189729
Allison et al. 2016. Nature 530: 27-29.

Three strikes against Bradley et al. 2015

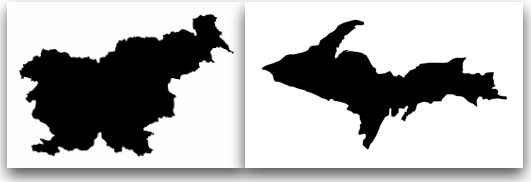
1. Data are secret
2. Methods could not be replicated
3. Inappropriate baseline comparison (no control condition for full pack removal)

1. Bradley et al. 2015. Journal of Wildlife Management 79: 1337–1346.
2. COPE = Committee on Publication Ethics https://publicationethics.org/ and Krausman 2022. The Journal of Wildlife Management 86: e22167.
3. Santiago-Avila et al. 2018.. PLoS One 13: e0189729
4. Allison et al. 2016. Nature 530: 27-29.

Lethal management of large carnivores:
Effects, side-effects, and gaps in knowledge
Three studies comparing livestock losses before and after grey wolves were killed

Effect on livestock predation	France [a] (% of regions showing a given effect of killing wolves)	Slovenia [b] (entire country, % of years with the given effect of killing wolves)	Michigan U.P. [c] (change in hazard ratios %)
Desired reduction	33%	28%	-25% [c]
Undesirable increase	11%	65%	+75% [c]
No effect	55%	7%	Overall [c]

[a] France: 9 regions (Grente 2021), reporting the author's summary conclusions of non-randomized before-and-after comparison.
[b] Slovenia: nationwide (Krofel *et al.* 2011) and (Treves *et al.* 2016). Simple correlation and after-before, nonrandomized respectively.
[c] Michigan, USA: (Santiago-Avila *et al.* 2018a,b). Although the overall effects of killing grey wolves was non-significant, we present the relative probabilities computed as changes in hazard ratios for target farms and non-target farms 19.2-28.8 km away (both -25% meaning lower risk) in contrast to non-target farms within 19.2 km (+75% meaning higher risk).



Gaps in knowledge: We lack randomized, controlled trials for wolves, bears, cougars, coyotes.

See unresolved debates among scientists

\Teichman et al. 2016. BMC Ecology 16: 44

Laundré & Papouchis, 2020. PLoS ONE 15: e0224638.

Peebles, et al. 2013. PLoS ONE 8: e79713.

Treves et al. 2022. Comment on Laundré & Papouchis. PLoS One.

Kertson et al. 2022. WDFW, Olympia, Washington, USA,

Northrup et al. 2022. Journal of Wildlife Management 87: e22363.

Garshelis et al. 2020. PLoS One 15: e0237274.

Conner et al. 1998. Journal of Wildlife Management 62: 690-699.

Knowlton et al. 1999. Journal of Range Management 52: 398-412.

For explanations of why USDA “experiments” are unreliable, see Webpanel 1 in Treves et al. 2016. Frontiers in Ecology and the Environment 14: 380-388.

We do have RCTs for badgers and red foxes.

UK badger killing to control bovine tuberculosis (bTb): Comparing no killing to targeted killing of infected badger families to culling without regard to infection, researchers [19-21] concluded bTb was likely to spread and as likely to increase as to diminish.

Over 2 years, Australian researchers [22] reported “no effect of fox control” (using poison) on lamb production. Fox control reduced the percentage of lamb carcasses classified as killed by foxes from 1·5-10.25% to 0·9-6.5% (fox control once per year) or 0·25-3.75% (fox control three times per year). “Poisoning did not affect fox abundance in spring. Some fox control may be wasted.”

19. Bielby et al. 2016. PLos ONE 11: e0164618.
20. Donnelly & Woodroffe, 2012. Nature 485: 582.
21. Vial & Donnelly, 2012. Biology Letters 8: 50-53.
22. Greentree et al. 2000. Journal of Applied Ecology 37: 935-943.

Common fact claim

Protect livestock?

- The best studies say little or no effect and some risk of raising livestock losses

Common fact claim

Raise human tolerance for wolves?

- Human attitudes?
- Human behavior?

What effect did legalizing or liberalizing wolf-killing have on attitudes among Wisconsin residents?

L. Naughton, PhD

J. Hogberg, MS

Treves et al. 2013 measured attitudes to wolves among Wisconsin residents over a 5–8 year period including many changes in policy and human-wolf interactions. Tolerance for wolves declined significantly and inclination to poach wolves increased despite several periods of liberalized wolf-killing.

Browne-Nuñez et al. 2015; used focus groups and anonymous surveys (quantitative and qualitative mixed-methods) undertaken both before and after delisting and changes in policy that re-initiated lethal control of wolves.They found that attitudes to wolves did not change, and inclination to poach appeared to stay the same or increase. Calls to kill more wolves through public hunting and trapping increased.

Hogberg et al. (2015) used a quantitative mail-back survey to residents living in wolf range, comparing attitudinal measures from the same persons sampled in 2009 and resampled in 2013. They found that male residents of wolf range in Wisconsin had lower tolerance for wolves compared to their tolerance in 2009. The most significant change in policy was the inauguration of a wolf hunting and trapping season in 2012, after delisting and associated lethal control in two periods from 2009-2012.

C. Browne-Nuñez, PhD

Naughton-Treves wt al. 2003. Conservation Biology 17: 1500-1511.

Browne-Nuñez et al. 2015. Biol. Conserv. 189, 59–71.

Hogberg et al. 2015. Conserv. 43, 45-55.

Treves & Bruskotter, 2014. Science 344: 476-477.

Treves et al. 2013. Conserv. Biol. 27, 315–323.

Legalizing or liberalizing wolf-killing did NOT improve the survival of other individual radio-collared WI wolves, Mexican gray wolves, or red wolves in the wild. In many cases, deaths from poaching or disappearances increased after those policies were enacted.

Legalizing or liberalizing wolf-killing was followed by slow-downs in population growth of gray wolves and Mexican gray wolves. Hunting seasons for bears and deer, hound-training seasons, and snow-cover seasons were associated with significant increases in wolf poaching.

F. Santiago-Ávila, PhD & his dogs Leeloo and Ninja

Naomi X. Louchouarn, M.E.S.M.

G. Chapron, PhD

Chapron & Treves 2016. B Proceedings of the Royal Society B 283, 20152939.
Chapron & Treves 2016. Proceedings of the Royal Society B 283, 20162577.
Chapron & Treves 2017. Proceedings of the Royal Society B 2016257, 20162571.
Chapron & Treves 2017. Proceedings of the Royal Society B 284, 20171743.
Louchouarn et al. 2021. Royal Society Open Science 8, 200330.
Santiago-Ávila et al. 2020. Scientific Reports 10, 13881. /10.1038
Santiago-Ávila & Treves 2022. Scientific Reports 12, e1738.
Louchouarn 2023. Phd Thesis, University of Wisconsin-Madison.

Legalizing or liberalizing wolf-killing did not improve the survival of individual radio-collared wolves in the wild or population growth.

Legalizing or liberalizing wolf-killing was followed by a 121% increase in disappearances of collared Mexican wolves, best explained by cryptic poaching. The policies were followed and a 5-10% slow-down in population growth of Mexican gray wolves (Louchouarn et al. 2021).

F. Santiago-Ávila, PhD & his dogs Leeloo and Ninja

Naomi X. Louchouarn, PhD

Legalizing or liberalizing wolf-killing was followed by an 11-34% greater hazard of disappearances and +10% rise in the incidence of death or disappearance of WI wolves and 50-100% increase in disappearances of red wolves (Santiago-Ávila et al. 2020, 2022a; Santiago-Ávila & Treves 2022).

G. Chapron, PhD

Legalizing or liberalizing wolf-killing was associated with 4-9% slow-down in population growth of Wisconsin & Michigan wolves (Chapron & Treves 2016a,b, 2017a,b)

Common fact claim

Raise human tolerance for wolves?

In Wisconsin the opposite happened.






Common fact claim

Protect human safety?

2002-2020 worldwide, 489 human victims with 25-26 fatal (6%).

Rabies 59%
Predatory 36%
8% “provoked [by people] / defensive”

Rabies and starving wolves are vanishingly rare in North America, where we have 1 confirmed and one suspected

Linnell, J. D., E. Kovtun, and I. Rouart, 2021. Wolf attacks on humans: An update for 2002–2020. Norwegian Institute for Nature Research, Modified by a series of reports from Dr. Paul Paquet and colleagues about a case in Canada.

Common fact claim

Protect human safety?

Current law allows one to kill a wolf that poses immediate threat to human safety

Scientific consensus says widespread wolf-killing or any proactive killing will not help.

Treves, A., J. T. Bruskotter, and L. M. Elbroch, 2024. Evaluating fact claims accompanying policies to liberalize the killing of wolves, peer-reviewed chapter TBA peer-reviewed chapter TBA In press. Alpha Wildlife Publications, Canada. https://faculty.nelson.wisc.edu/treves/pubs/Evaluate%20fact%20claims%20about%20killing%20wolves_2024.pdf

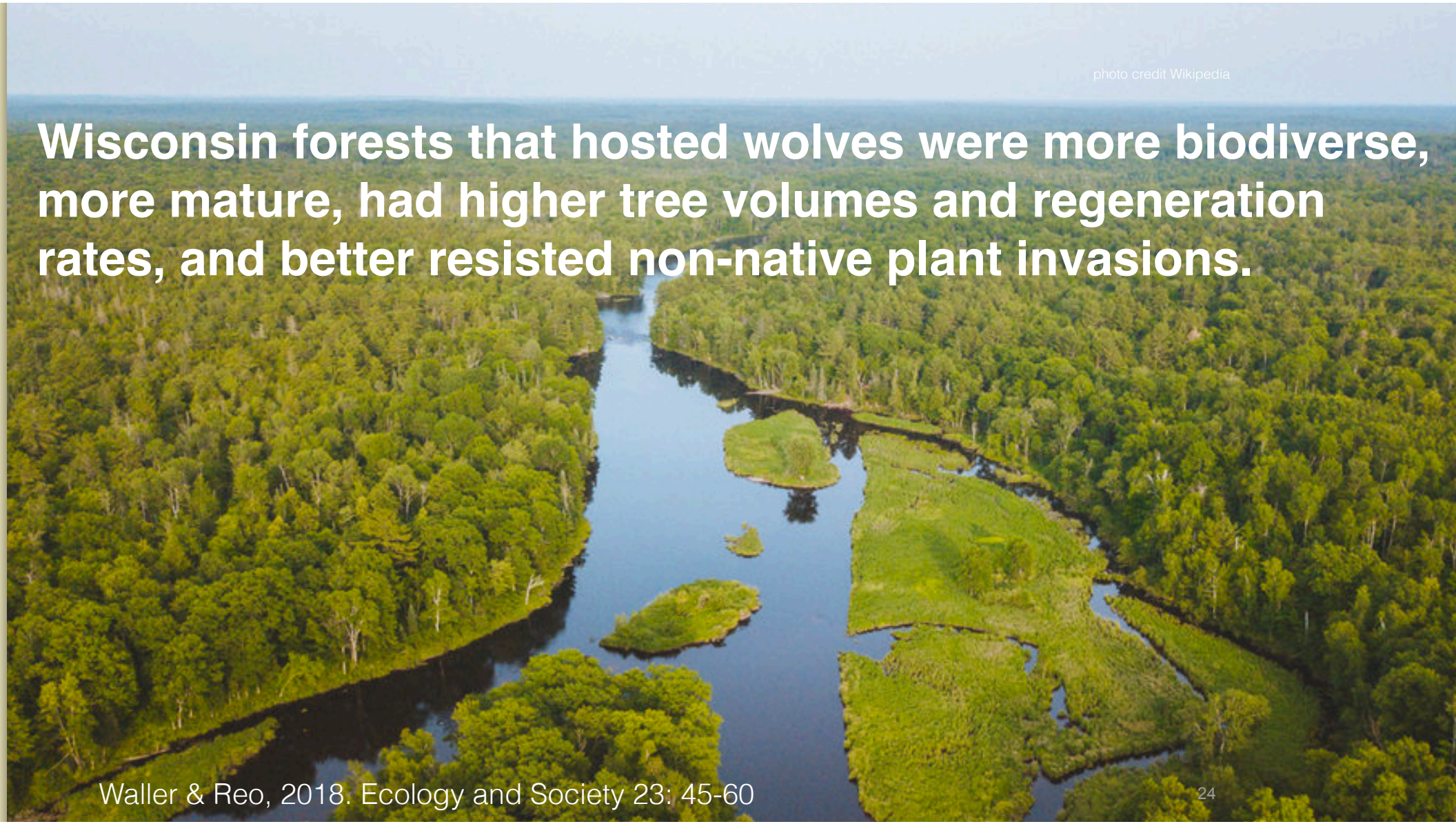
Common fact claim

Protecting ungulate populations?

Density-dependence

The rarely stated benefits

Losing benefits for ecosystems and for people



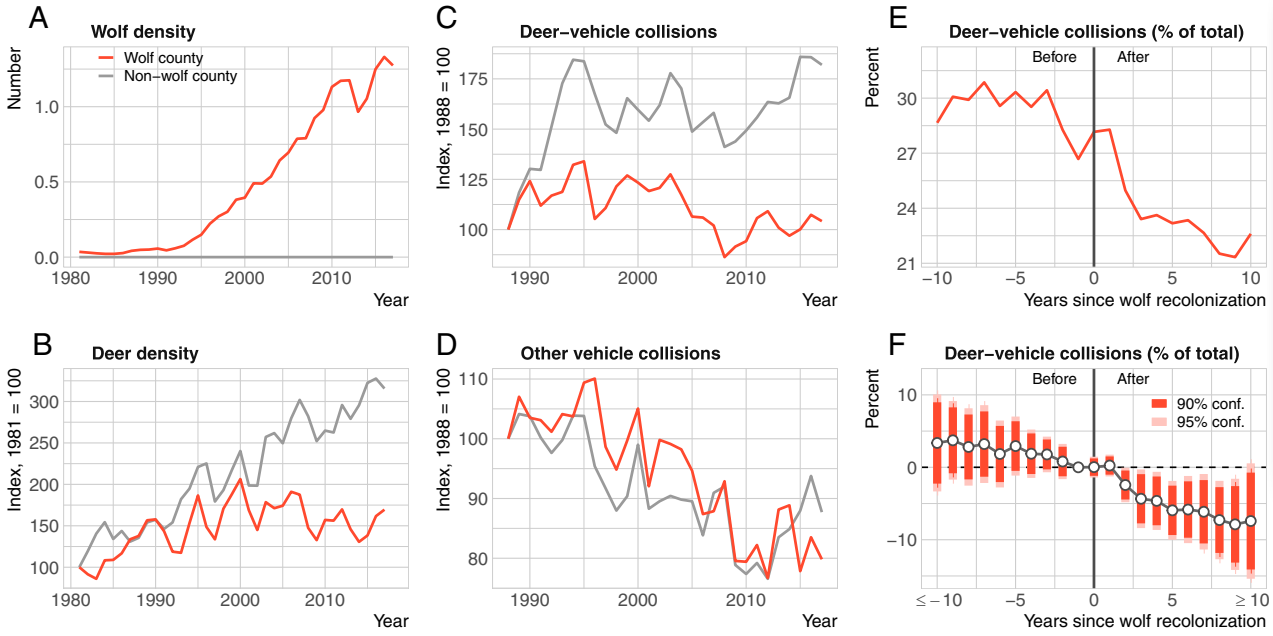
Wisconsin forests that hosted wolves were more biodiverse, more mature, had higher tree volumes and regeneration rates, and better resisted non-native plant invasions.

Waller & Reo, 2018. Ecology and Society 23: 45-60

WI wolf packs seem to have protected some understory plants from deer herbivory.

Nodding trillium
benefits from wolves?

Callan et al. 2013. Journal of Ecology 101: 837–845



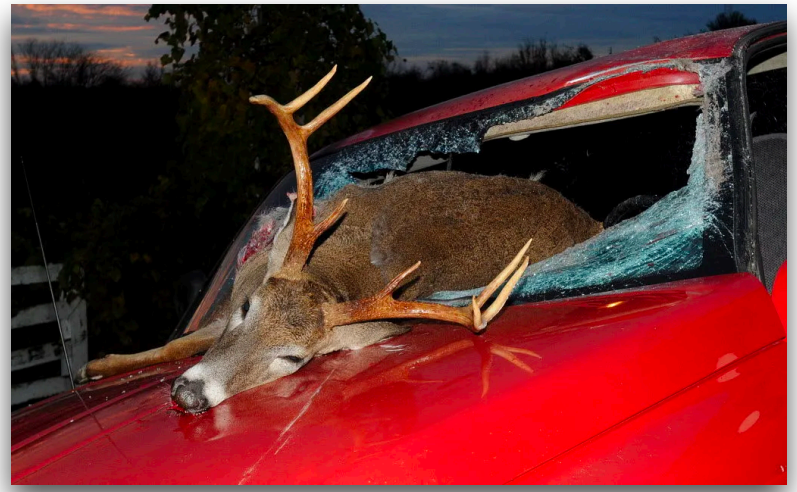


Fig. 2. Trends in wolf abundance, deer abundance, and roadway collisions. (*A*) Winter wolf population per 100 km^2 of deer range. Deer range is defined as permanent cover at least 4 ha in size in 1993, the only year available. (*B*) Prehunt deer population per km^2 of deer range. (*C*) Vehicle collisions caused by deer. (*D*) Vehicle collisions not caused by deer. (*E*) Percent of vehicle collisions caused by deer before and after wolves enter a county, 1988 to 2010. (*F*) Percent of vehicle collisions caused by deer regressed on indicator variables for years since wolf recolonization, county, and year, 1988 to 2010. SEs clustered at the county level. (*E* and *F*) Data exclude three counties with wolf exit at some point during the period.

Raynor et al. 2021. Proceedings of the National Academy of Sciences 118, e2023251118.

Counties in Wisconsin hosting wolves had fewer deer-vehicle collisions than (a) the same counties before wolves recolonized, (b) counties without wolves in same time period, (c) counties with recent wolf recolonization improved as much as counties with early wolf recolonization (so we aren't confusing road/traffic/vehicle improvements over time with wolf recolonization over time). The longer wolves were established the steeper the declines in deer-vehicle collisions. Other causes of vehicle collisions did not differ between counties with and without wolves.

economic benefit minus costs

Wisconsin, the monetary benefits of wolves overwhelm the rare costs of coexistence (Raynor et al. 2021). Forest value was higher where wolves had long established (Waller & Red 2018).

Many people enjoy hearing wolves, tracking them, and knowing they are alive out there. In Yellowstone, people paid millions to see wolves.

Duffield & Neher, 1996. Transactions of the North American Wildlife and Natural Resources Conference 61: 285-292.
Duffield et al. 2008. George Wright Forum 25: 13-19.

Have these benefits been studied in your state? Do decision-makers mention them? If not, why not?

Conclusions

Scientists always want more data. Policy-makers might say “We must decide now.”

Science-policy interface (Oreskes 2019):

Uncertainty

Peer review, journals, Open Science, and the Committee Committee on Publication Ethics (COPE https://publicationethics.org/).

When should we trust science and when should we mistrust it?

Thank you

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