Wolf Science Panel

Lethal removal of wolves to minimize wolf-livestock conflict

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Washington Department of FISH and WILDLIFE

Purpose of Presentation

- Discuss the role of science in wolf policy and management
- Reliable knowledge
- Inference
- Recent publications and “body of science”
- Management implications

Role of Science

WDFW reviews science constantly

- Hypothesis testing, repeatable
- Science not truth, informs decision making
- "Grey-science"
- Body of knowledge vs single publications
- Decisions aren't always based solely on science

Reliable Knowledge

Which studies are the most informative?

Least

Most

1. Evaluate subpopulation trends
2. Investigate demographics of species
3. Apply treatment to population and measured response
4. Treatment and control design, randomly apply treatment, then replicate

Inference

- Environmental conditions
- Changing conditions in time and space
- Other species in system
- Confounding factors
- Power, precision, and accuracy of statistical tests

Publications

1. Borg, B.L., S.M. Brainerd, T.J. Meier, and L.R. Prugh. 2014. Impacts of breeder loss on social structure, reproduction and population growth in a social canid. Journal of Animal Ecology; DOI: 10.1111/1365-2656.12256.

2. Bradley, E.H., H.S. Robinson, E.E. Bangs, K. Kunkel, M.D. Jimenez, J.A. Gude, and T. Grimm. 2015. Effects of wolf removal on livestock depredation recurrence and wolf recovery in Montana, Idaho, and Wyoming. The Journal of Wildlife Management; DOI: 10.1002/jwmg.948.

3. Brainerd, S.M., A. Henrik, E.E. Bangs, E.H. Bradley, J.A. Fontaine, W. Hall, Y. Iliopoulos, M.D. Jimenez, E.A. Jozwiak, O. Liberg, C.M. Mack, T.J. Meier, C.C. Niemeyer, H.C. Pedersen, H. Sand, R.N. Schultz, D.W. Smith, P. Wabakken, and A.P. Wydeven. 2008. The effects of breeder loss on wolves. Journal of Wildlife Management 72:89-98.

4. Chapron, G., and A. Treves. 2016. Blood does not buy good will: allowing culling increases poaching of a large carnivore. Proc. R. Soc. B 20152939. http://dx.doi.org/10.1098/rspb.2015.2939.

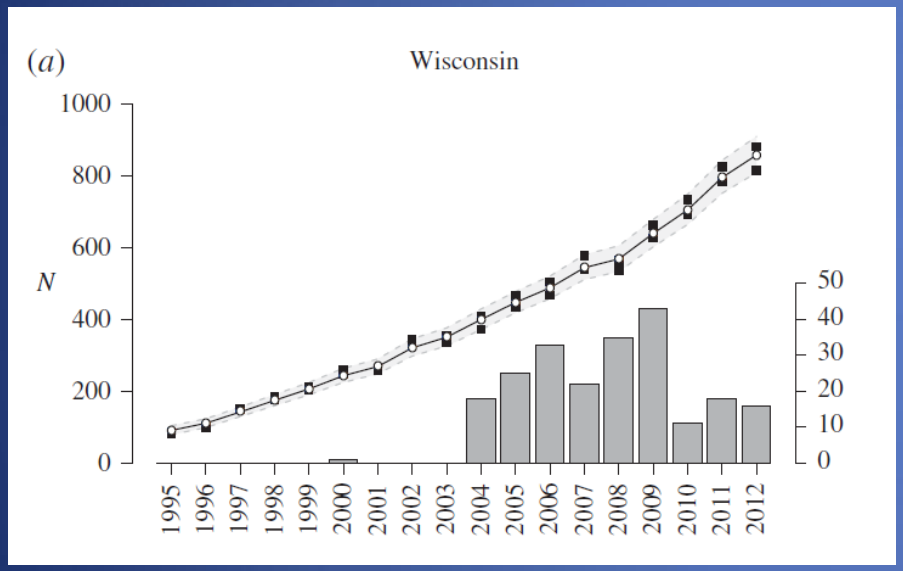
5. Olson, E.R., J.L. Stenglin, V. Shelley, A.R. Rissman, C. Brown-Nunez, Z. Voyles, A. Wydeven, and T. Van Deelen. 2014. Pendulum swings in wolf management led to conflict, illegal kills, and a legislated wolf hunt. Conservation Letters DOI: 10.1111/conl.12141.

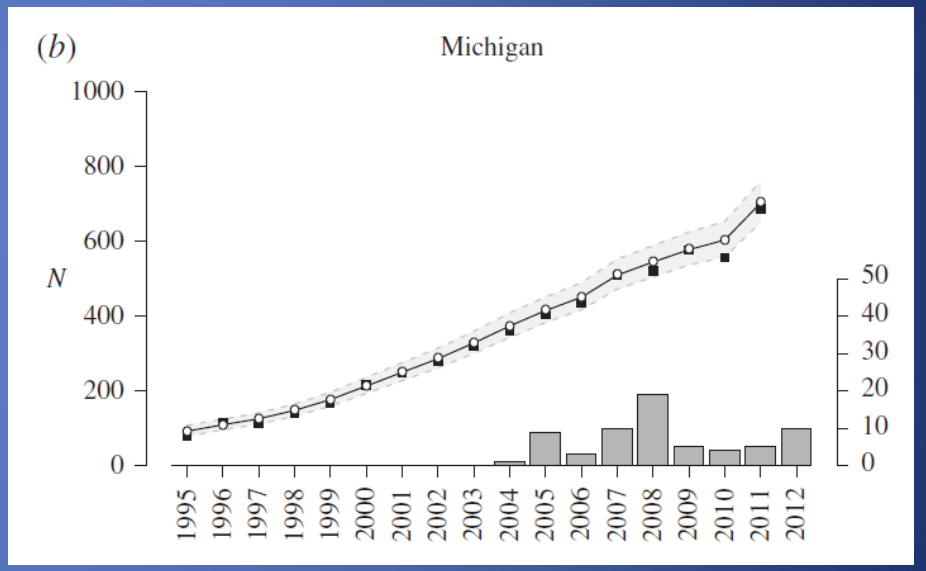
6. Treves, A., M. Krofel, and J. McManus. 2016. Predator control should not be a shot in the dark. Frontiers in Ecology 14:380-388.

7. U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, Montana Fish, Wildlife & Parks, Wyoming Game and Fish Department, Nez Perce Tribe, National Park Service, Blackfeet Nation, Confederated Salish and Kootenai Tribes, Wind River Tribes, Confederated Colville Tribes, Spokane Tribe of Indians, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Utah Department of Natural Resources, and USDA Wildlife Services. 2016. Northern Rocky Mountain Wolf Recovery Program 2015 Interagency Annual Report. M.D. Jimenez and S.A. Becker, eds. USFWS, Ecological Services, 585 Shepard Way, Helena, Montana, 59601. NOTE: annual reports with associated information and tables can be found at https://www.fws.gov/mountain-prairie/es/grayWolf.php and select “Annual Reports...” then the years you want.

Chapron, G., and A. Treves. 2016. Blood does not buy good will: allowing culling increases poaching of a large carnivore. Proc. R. Soc. B 20152939. http://dx.doi.org/10.1098/rspb.2015.2939.

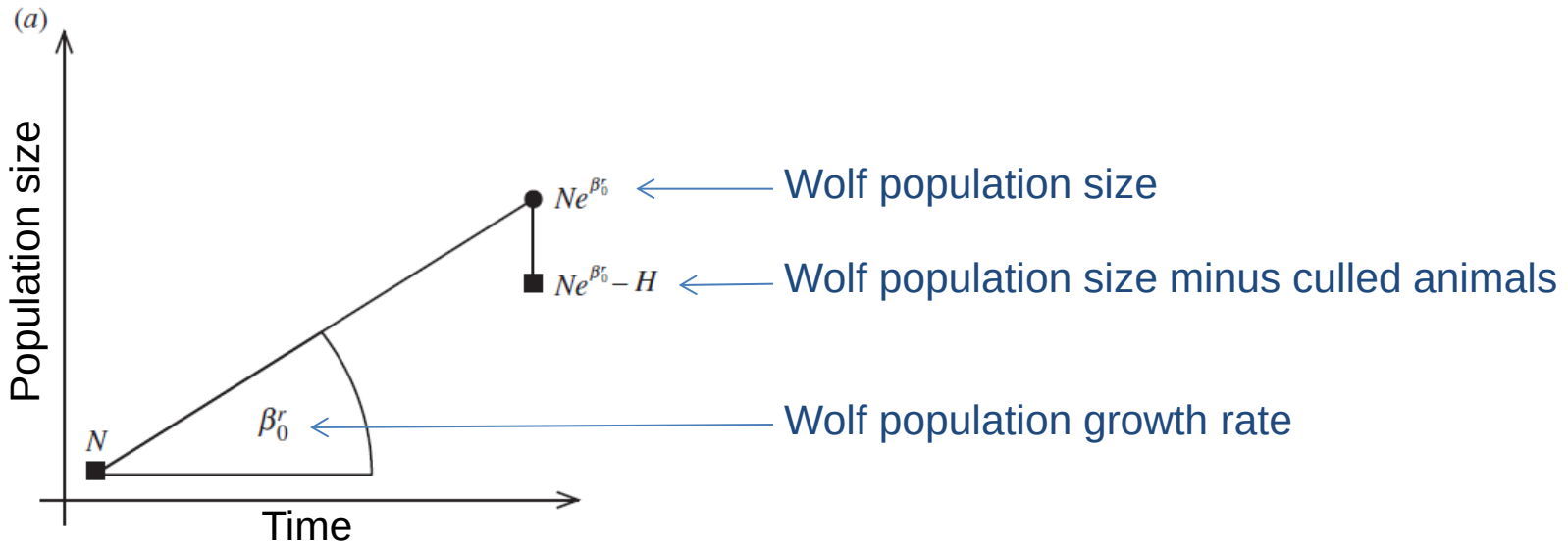
Hypothesis: Liberalizing wolf culling will reduce poaching and improve population status of wolves





Wolf population history in Wisconsin and Michigan. The black squares are FWS population counts (scale on left axis, minimum and maximum for Wisconsin, minimum for Michigan), the grey area is the 95% credible interval of the fitted population model, the histogram shows the number of wolves culled (scale on right axis).

Conceptual model of how culling policy signal influences growth rate



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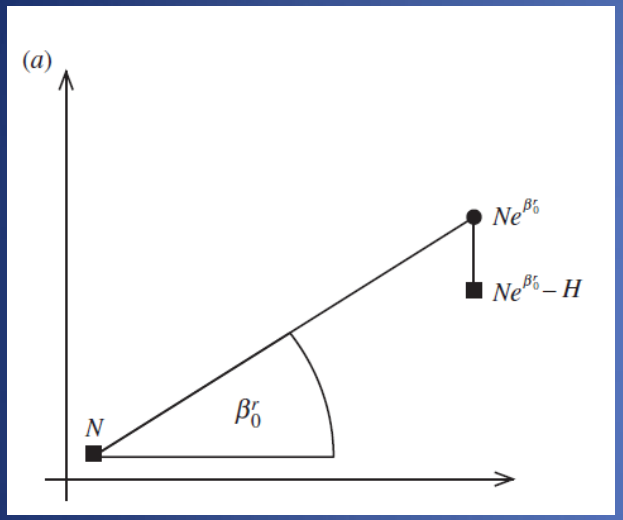
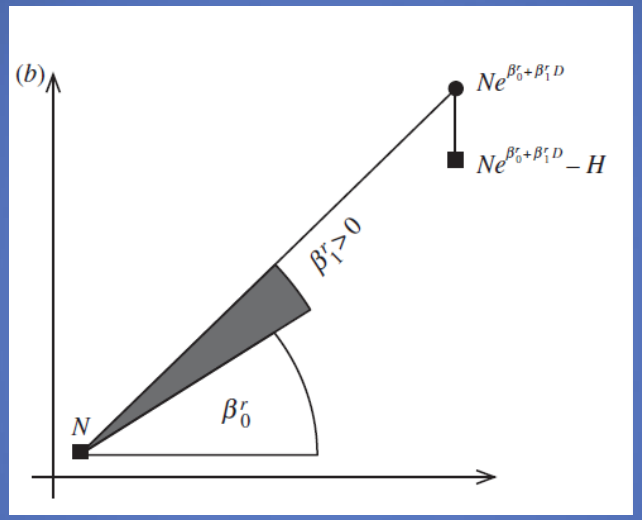
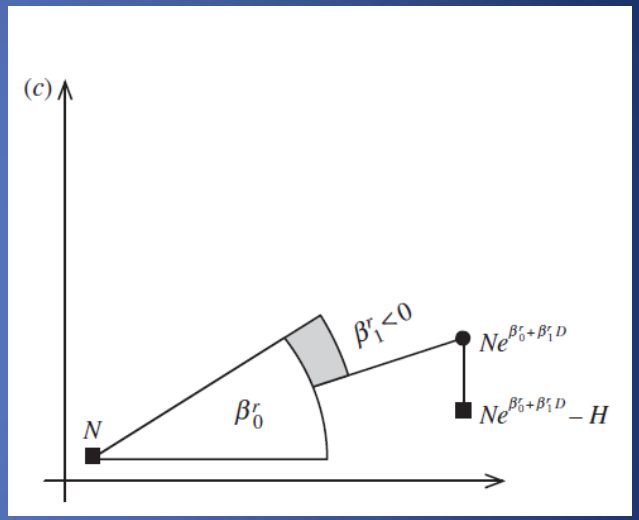


From one time step to the next (horizontal axis), a population has a potential growth rate which does not account for the animals culled.



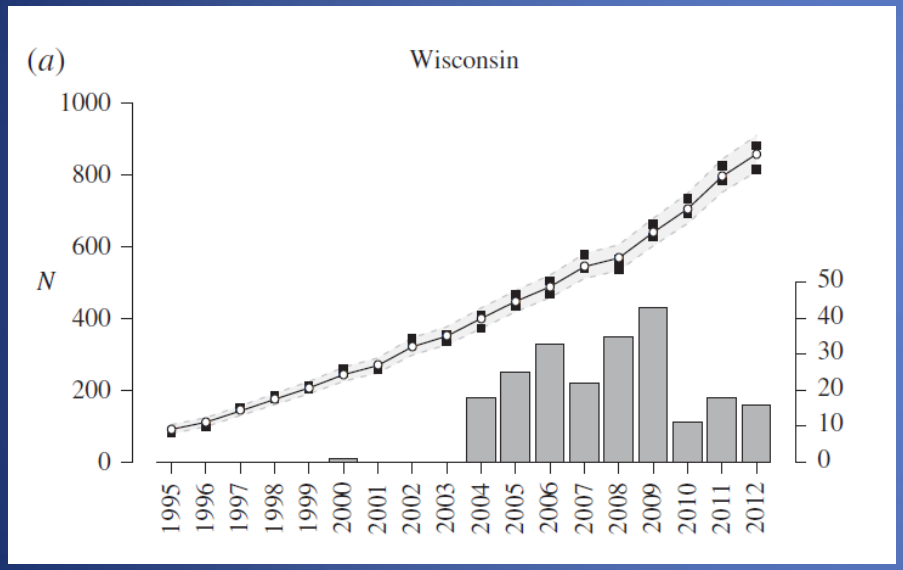
With a culling policy signal lasting duration D (proportion of a year), the potential growth rate increases through a decrease of poaching.

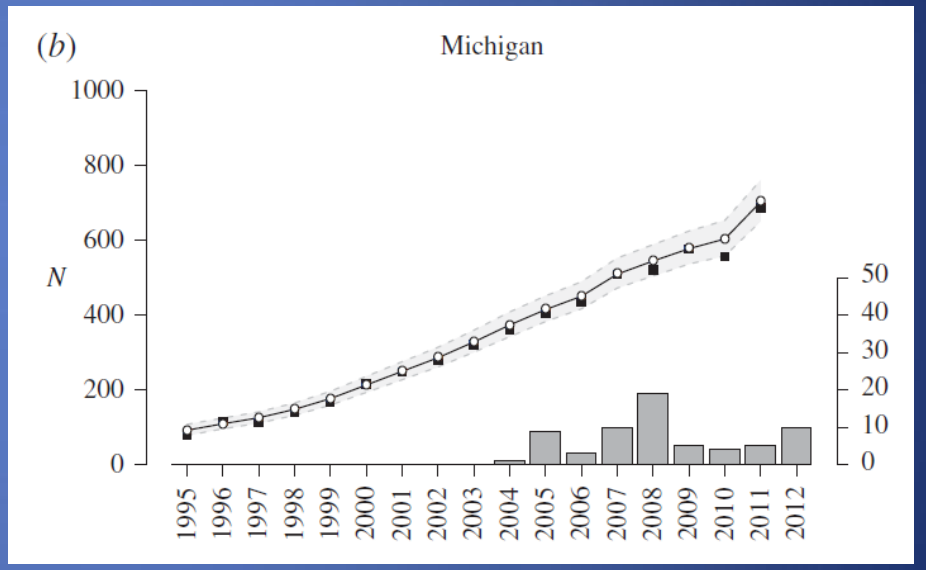


With a culling policy signal lasting duration D (proportion of a year), the potential growth rate decreases through a increase of poaching.

Hypothesis: Liberalizing wolf culling will reduce poaching and improve population status of wolves

→ Outcome: Liberalizing wolf culling did not reduce poaching and improve population status of wolves.





Growth rate change:

- No signal: 0.16 (95%CI: 0.12-0.20)
- Culling signal: 0.12 (95%CI: 0.07-0.19)

Growth rate change:

- No signal: 0.14 (95%CI: 0.10-0.18)
- Culling signal: 0.10 (95%CI: 0.05-0.17)

Comments on Study

- Limitations of retrospective study design
- Model is correlation, assumption that poaching is causal mechanism
- Assumption on no confounding factors, interactions, or time lags associated with social response (i.e., poaching)
- Assumption with census reliability

Management Implications

- Need greater understanding on variables that influence social tolerance
- Assess goal of lethal removal

Treves, A., M. Krofel, and J. McManus. 2016. Predator control should not be a shot in the dark. Frontiers in Ecology 14:380-388.

- Objective: Review studies evaluating functional effectiveness of intervention (non-lethal or lethal methods) to protect livestock from wild predators.

- Compare studies to "gold standard" of scientific inference
  - Random assignment to control and treatment groups with experiential design

- "Silver standard"
  - Non-random assignment
  - Quasi-experimental test with haphazard assignment of treatments

- Inclusion for quantitative summary
  - Peer-reviewed
  - English and Slovenian
  - Used experimental or quasi-experimental control with design for strong inference
  - Occurred in working livestock operations with free-ranging, native carnivores
  - Verified livestock losses

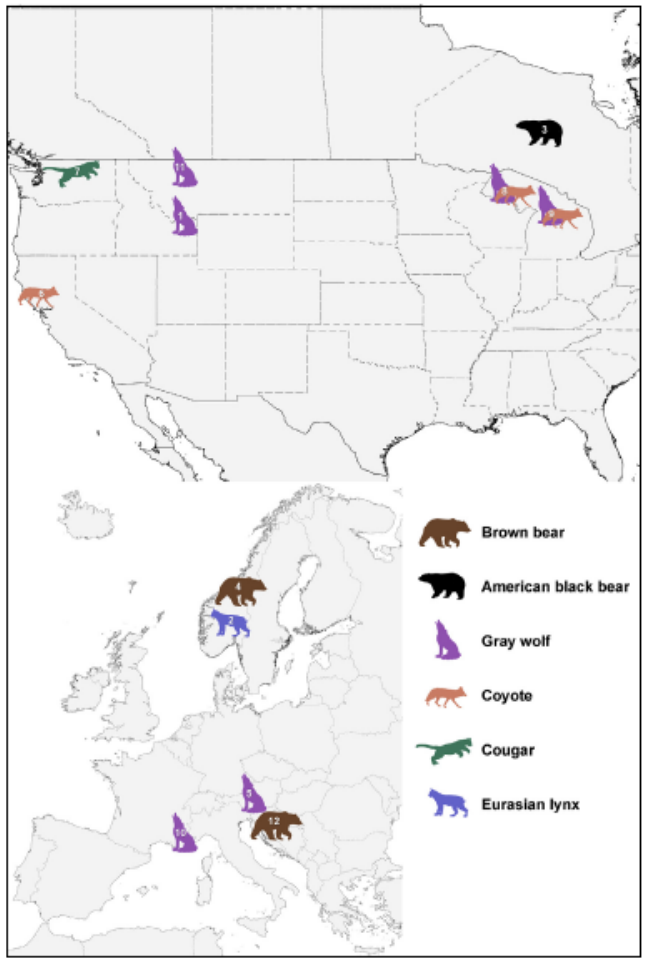


Figure 1. The geographic distribution of tests of lethal and non-lethal methods providing reliable inference about functional effectiveness in preventing carnivore predation on livestock from North American and European livestock farms. Numbers correspond to those in Table 1.

Results

- 12 tests meet gold or silver standard
- Lethal methods – 7 tests met silver standard
  - 2/7 reduced livestock losses from predation
  - 3/7 effect to livestock losses from predation
  - 2/7 increased livestock losses from predation
- Non-lethal methods – 5 tests met
  - 4/5 preventative effects
  - 1/4 preventative effects for 1 species, but another

Table 1. Tests of interventions to prevent carnivore predation on livestock that met review criteria

	Observed changes (if any) in livestock predation		
	Decrease	*No difference*	*Increase*
Lethal methods	Quasi-experimental tests of culling gray wolves (1) and culling, hunting, and poaching Eurasian lynx (2)	Quasi-experimental tests of hunting black bears (3*), hunting and culling brown bears (4), and culling and hunting gray wolves (5)	Quasi-experimental tests of culling coyotes (6) and hunting cougars (7**)
Non-lethal methods	Random assignment test of fladry on gray wolves (8), random assignment test of LGDs on gray wolves and coyotes (9), quasi-experimental tests of LGDs and night enclosures on gray wolves (10), and fladry on gray wolves (11)	Random assignment test of fladry on coyotes (8), quasi-experimental tests of diversionary feeding on brown bears (12)	

Notes: *Some complaints related to livestock predation but some related to property damage. **A quasi-experimental two-county comparison was reported in Peebles *et al.* (2013), based partly on the work of Cooley *et al.* (2009a,b). Sources of evidence are listed by number: 1 = Bradley *et al.* (2015); 2 = Herfindal *et al.* (2005); 3 = Obbard *et al.* (2014) see their Table S1 for use of moving averages; 4 = Sagør *et al.* (1997); 5 = Krofel *et al.* (2011) reanalyzed as after–before measures of livestock losses (WebPanel 1); 6 = Conner *et al.* (1998); 7 = Peebles *et al.* (2013) and Cooley *et al.* (2009a,b) treated as a single test for the two-county comparison, not the state-wide analysis; 8 = Davidson-Nelson and Gehring (2010); 9 = Gehring *et al.* (2010a,b); 10 = Espuno *et al.* (2004); 11 = Musiani *et al.* (2003); 12 = Kavčič *et al.* (2013). LGDs = livestock-guarding dogs. We excluded two studies that used time lags but not BACI designs to infer changes in livestock losses over time (eg Wielgus and Peebles 2014; Fernández-Gil *et al.* 2016).

Review Summary

- Most (10/12) tests did not meet gold standard
- More non-lethal tests were found effective at preventing depredations compared lethal tests
- No lethal tests met gold standard
- Two non-lethal tests provided strong inference
  - Fladry
  - Livestock guarding dogs

Comments on Study

- Good review from multi-species multi-ecosystem perspective
- Highlights importance of study design and study inference

Management Implications

- More research needed on effectiveness of non-lethal and lethal tools
- Importance of specifically stating objective of intervention
  - Is goal to minimize probability of reoccurring depredations today or in the future?

Brainerd et al. (2008)

Pooled worldwide available data

Borg et al. (2015)

Alaska long-term study (1986-2012)

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How loss / removal of breeders impacted wolf…

- Pup survival
- Reproduction
- Pack integrity/territoriality
- Population growth

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How loss / removal of breeders impacted wolf…

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Depending on…

- female, male or both
- Age of pups
- Size of pack / # of adults
- Isolation vs connectivity to other packs
- Size of surrounding wolf population
- Recolonizing vs saturated

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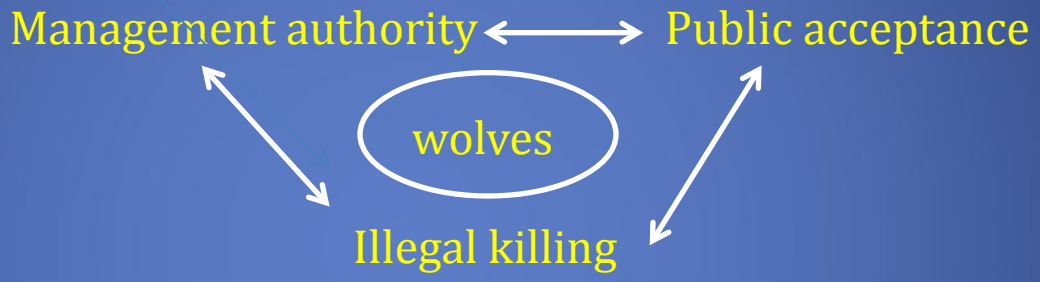
"Breeder mortality and pack dissolution had no significant effects on immediate or longer term population dynamics. …At the population level socially complex species may be resilient to disruption and harvest through strong compensatory mechanisms." (Borg et al. 2015)

Olson et al. (2014)

Wolf recolonization and Endangered Species Act (ESA) status in Wisconsin

Olson et al. (2014)

Wolf recolonization and Endangered Species Act (ESA) status in Wisconsin



Wolf ESA status swings -> inconsistent management authority

- Local public support for wolves declined
- "backlash" of increased illegal kills and a legislatively mandated wolf hunt

Olson et al. (2014)

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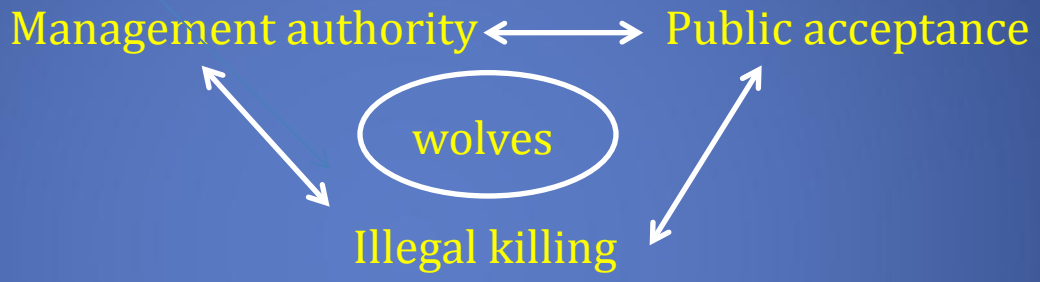

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- Consistent and responsible depredation management programs (or incremental delisting transition from federal to state) may reduce illegal killing

Olson et al. (2014)

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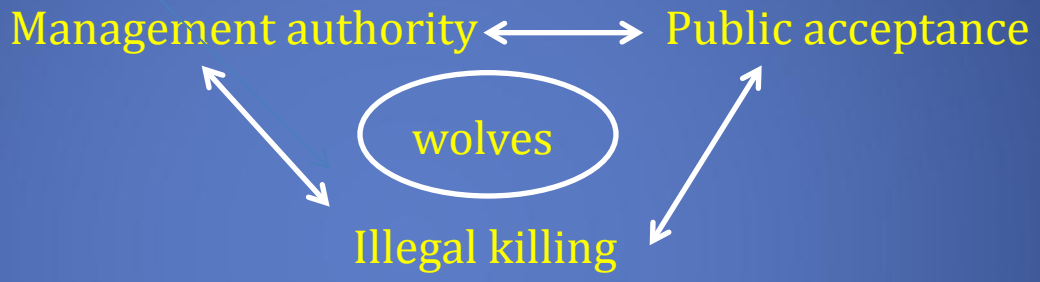

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  - "backlash" of increased illegal kills and a legislatively mandated wolf hunt
- Consistent and responsible depredation management programs (or incremental delisting transition from federal to state) may reduce illegal killing
- "…consider local perceptions of wildlife and … seek ways to empower non-consumptive users by providing more opportunities to participate…" (Olson et al. 2014)

Citations

Borg, B.L., Brainerd, S.M., Meier, T.J. and Prugh, L.R. 2015. *Impacts of breeder loss on social structure, reproduction and population growth in a social canid*. Journal of Animal Ecology, 84: 177–187.

Brainerd, S.M., Andrén, H., Bangs, E.E., Bradley, E.H., Fontaine, J.A., Hall, W., Iliopoulos, Y., Jimenez, M.D., Jozwiak, E.A., Liberg, O., Mack, C.M., Meier, T.J., Niemeyer, C.C., Pedersen, H.C., Sand, H., Schultz, R.N., Smith, D.W., Wabakken, P. and Wydeven, A.P. 2008. *The Effects of Breeder Loss on Wolves*. The Journal of Wildlife Management, 72: 89–98.

Olson, E.R., Stenglein, J.L., Shelley, V., Rissman, A.R., Browne-Nuñez, C., Voyles, Z., Wydeven, A. P. and Van Deelen, T. 2014. *Pendulum Swings in Wolf Management Led to Conflict, Illegal Kills, and a Legislated Wolf Hunt*. Conservation Letters, 8: 351–360.

Bradley, E. H., H.S. Robinson, E.E. Bangs, K. Kunkel, M.J. Jimenez, J.A. Gude, and T. Grimm. 2015. *Effects of wolf removal on livestock depredation recurrence and wolf recovery in Montana. Journal of Wildlife Management* 79:1337-1346

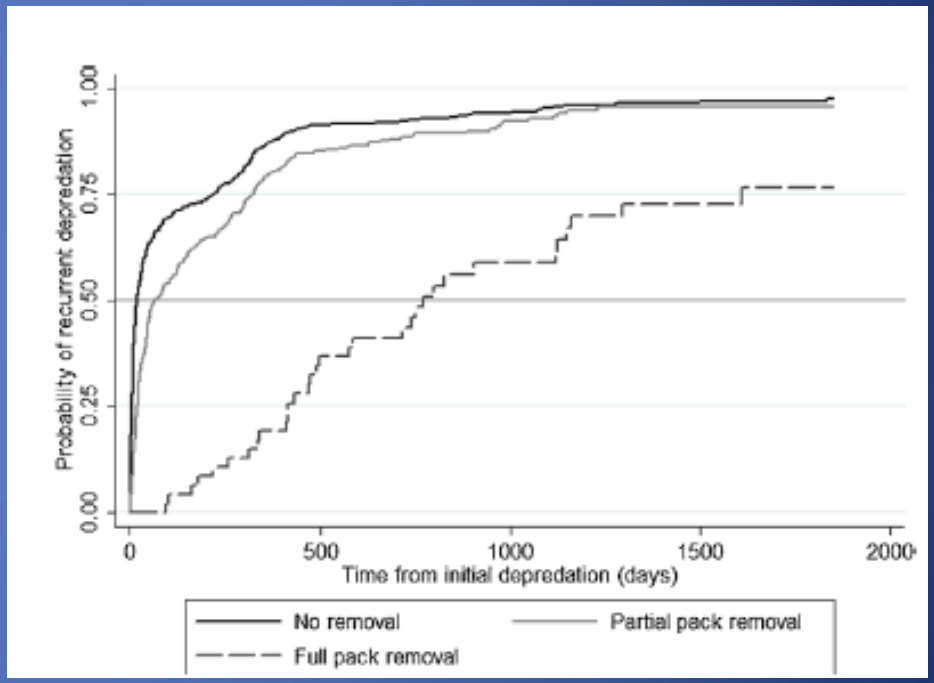
Objective 1: Evaluate the effects of three management responses to confirmed wolf depredations.

Significant in reducing recurrent depredations:

- Partial pack removal within 14 days
- Full pack removal the most effective

No difference found in reducing recurrent depredations:

- Season of removal
- Livestock involved



Bradley, E. H., H.S. Robinson, E.E. Bangs, K. Kunkel, M.J. Jimenez, J.A. Gude, and T. Grimm. 2015. *Effects of wolf removal on livestock depredation recurrence and wolf recovery in Montana. Journal of Wildlife Management* 79:1337-1346

Objective 2: Evaluate partial pack removals independently

Significant in reducing recurrent depredations:

- Larger pack sizes

No difference found in recurrent depredations of partial pack:

- when the breeding female
- ≥1 year old male removed.

Management action	Hazard ratio	SE	Z	P
Breeding F removed	0.6428	0.2214	−1.28	0.200
≥1-yr-old M removed	1.000	0.1828	0.00	0.998
Pack size following action	1.087	0.0353	2.59	0.010

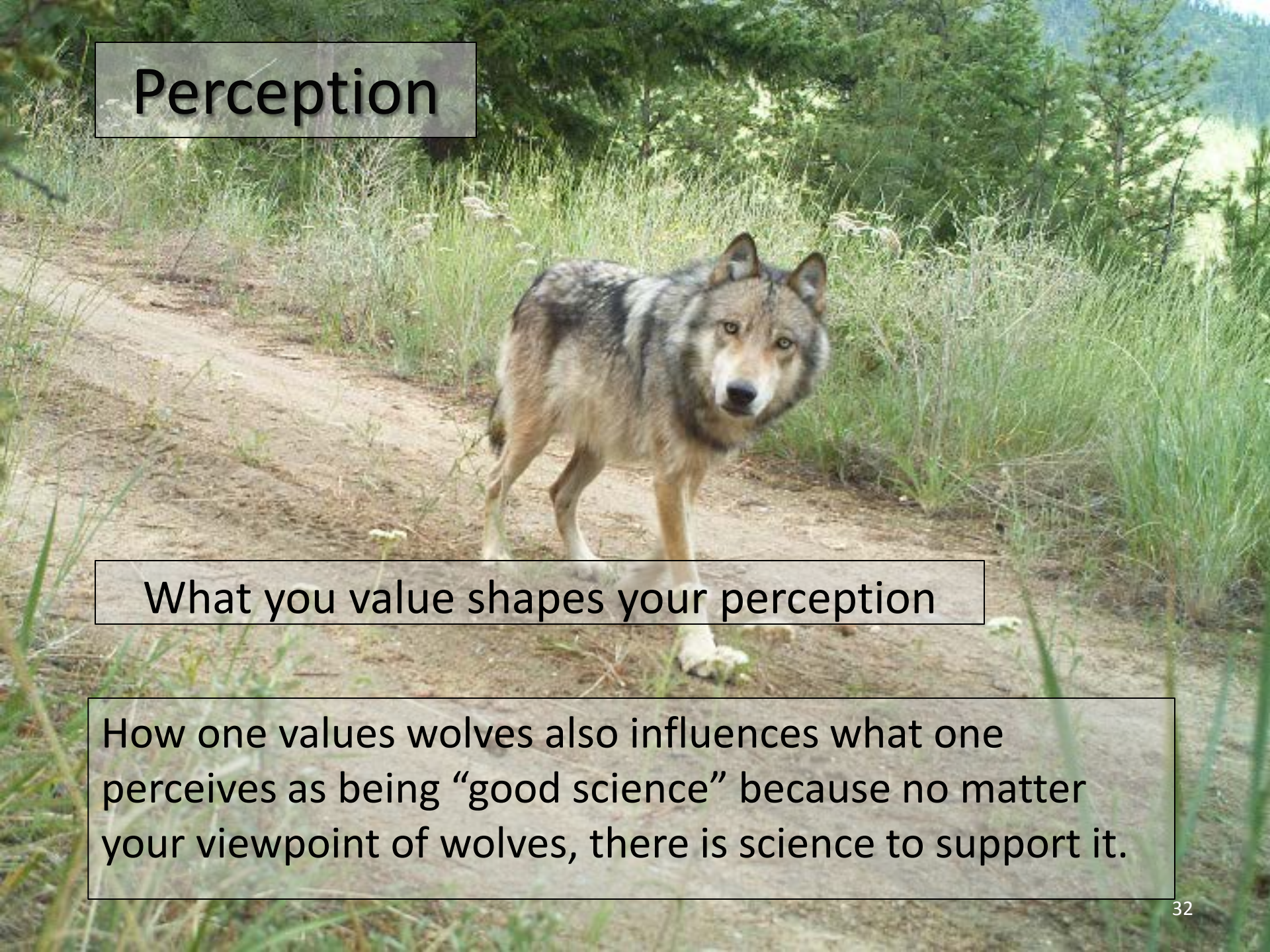
Management Implications

- Bradley et al. 2015 recommended swifter response after a confirmed depredation to reduce recurrent depredations
- Recovery may be compromised for the following year after a heavy removal

Perception

Definition: the way you think about or understand someone or something

Perception



What you value shapes your perception

How one values wolves also influences what one perceives as being “good science” because no matter your viewpoint of wolves, there is science to support it.

Differing Perceptions

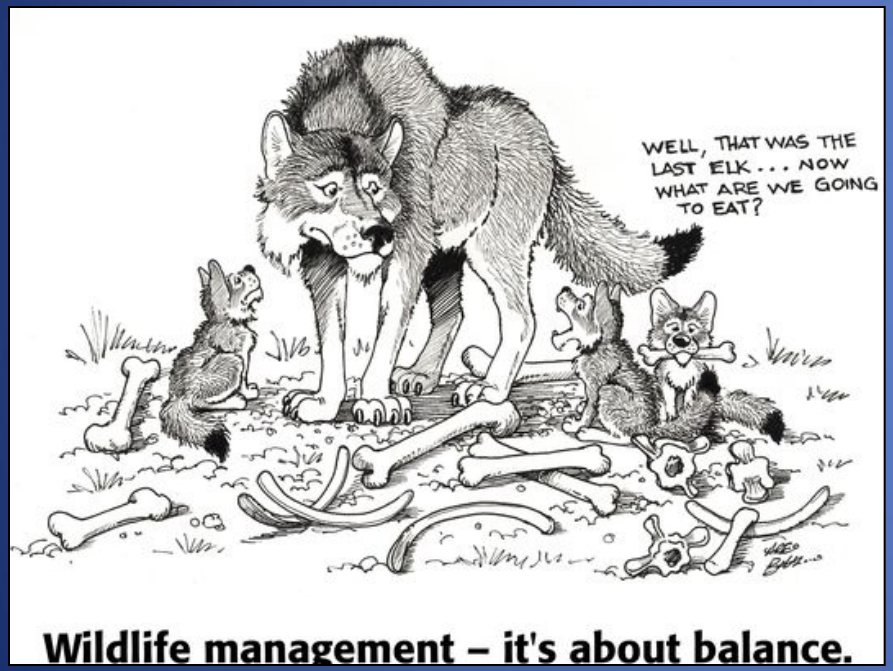
- Positive = perceived benefits
- Negative = perceived costs

- Perceptions become part of how an individual identifies themselves
- Attempts at persuasion are interpreted as personal attacks
- Individual identity also becomes a group identity (us versus them)

Where Do Wolf Managers Fit Into Equation?

- Basic goal of wolf recovery and management
  - How do we fit wolves into as many places as possible while minimizing conflict?
- Balancing opposing views while making management decisions based upon the best available science will always be the most challenging part of the job
  - If you're doing it right, no one will be happy!!!!
- As managers, we must try to:
  - Acknowledge viewpoints, but not become drawn in
  - Be the voice of reason
  - Be as objective as possible
  - Normalize the wolf

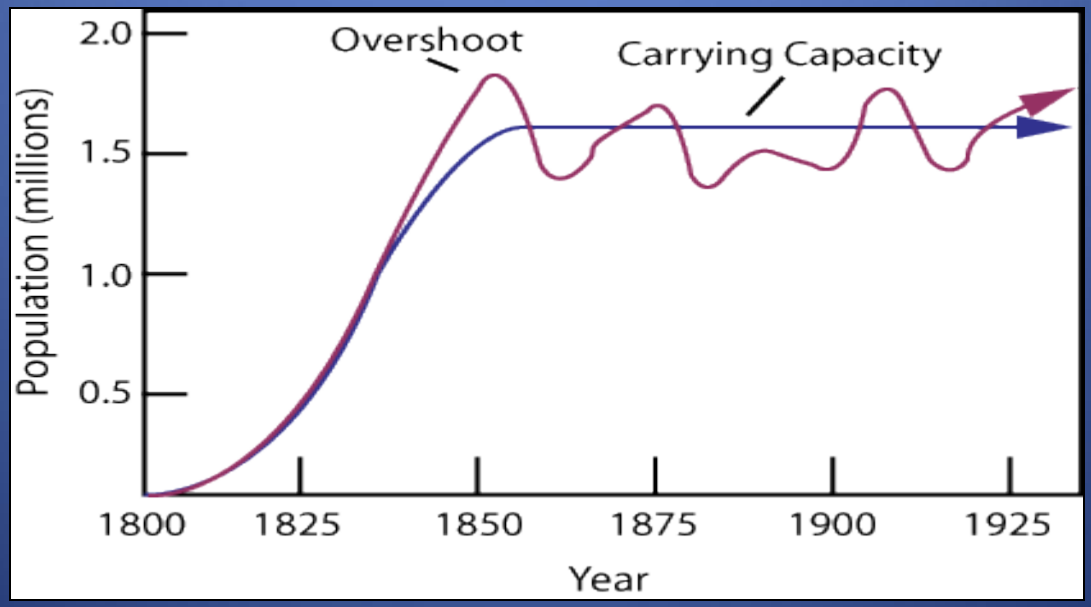
Wildlife Management 101



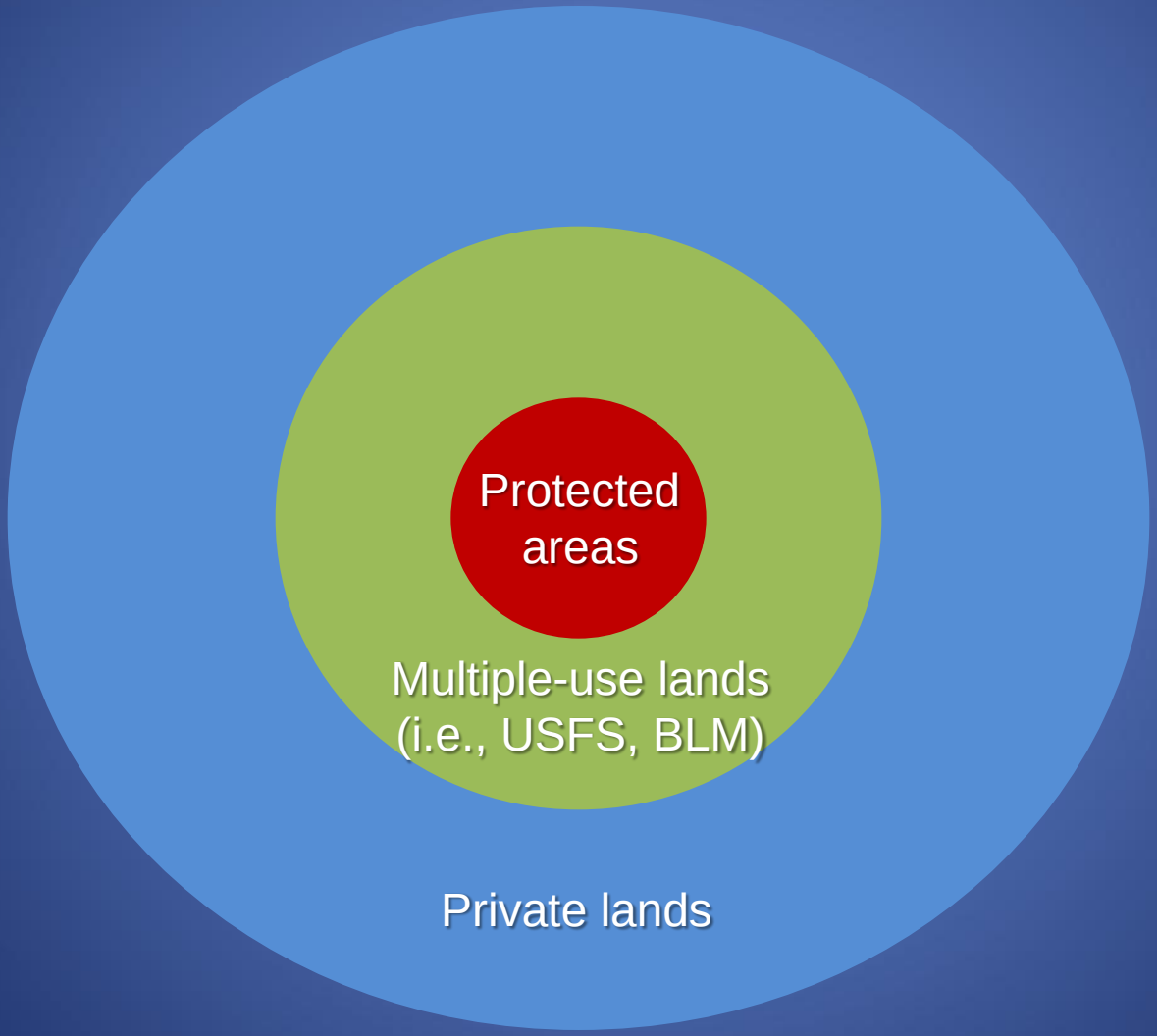
- Wildlife management is the art of balancing biological vs. social carrying capacity to achieve management and/or recovery objectives

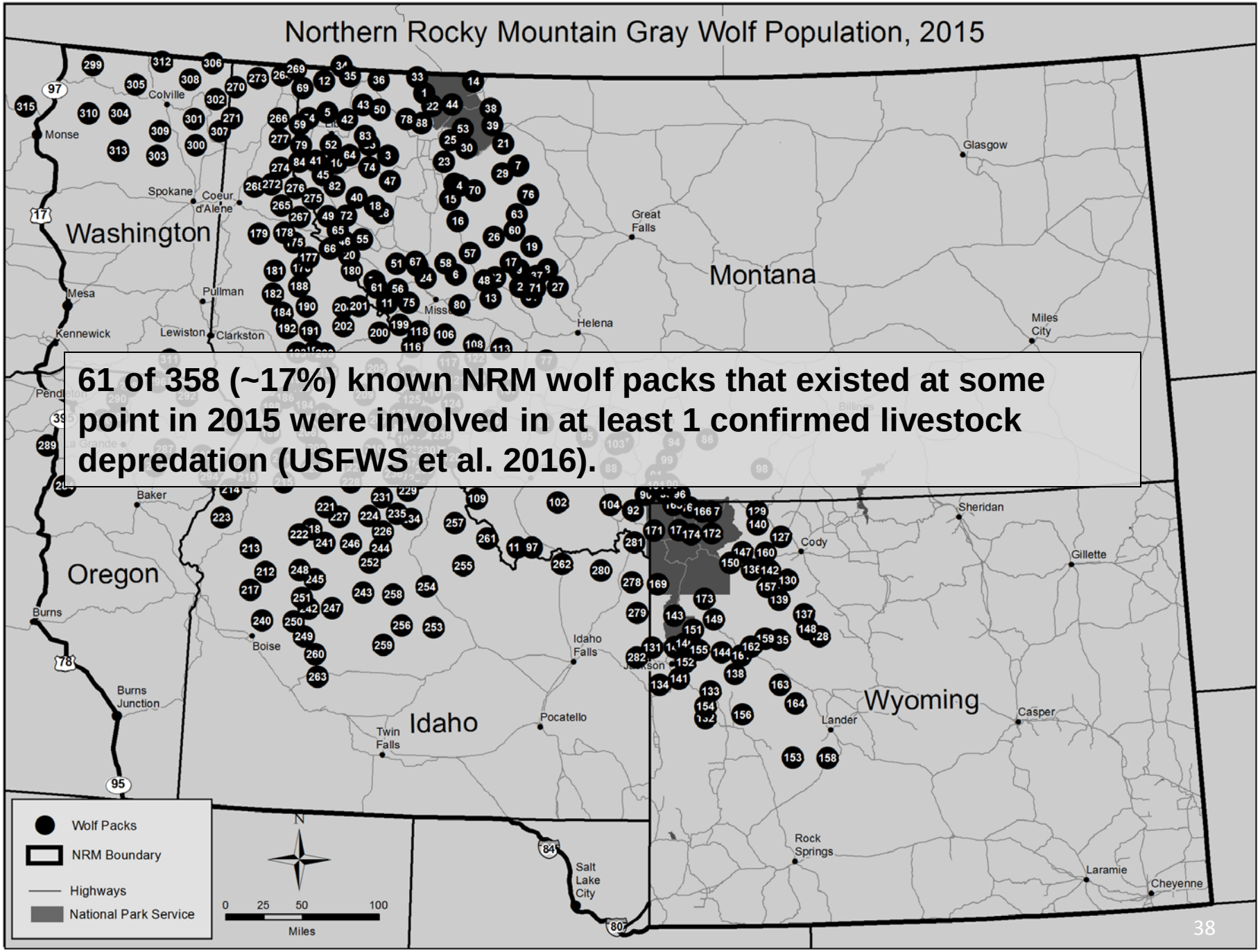
Biological vs. Social 'K'

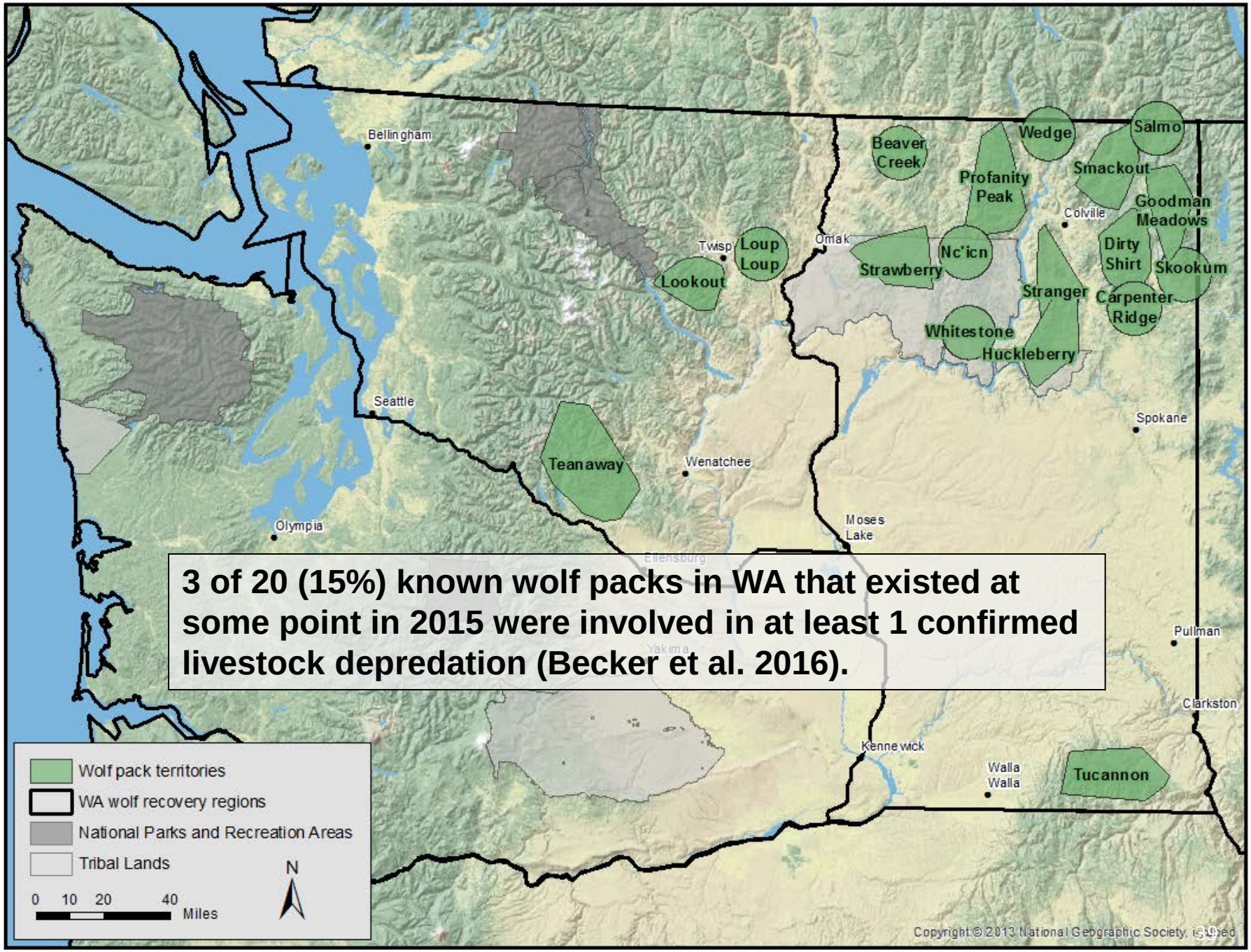
- Biological carrying capacity
  - How many animals can the habitat support?
- Social carrying capacity
  - Where will humans allow animals to exist on landscape?
  - Minimizing conflict
  - Social tolerance



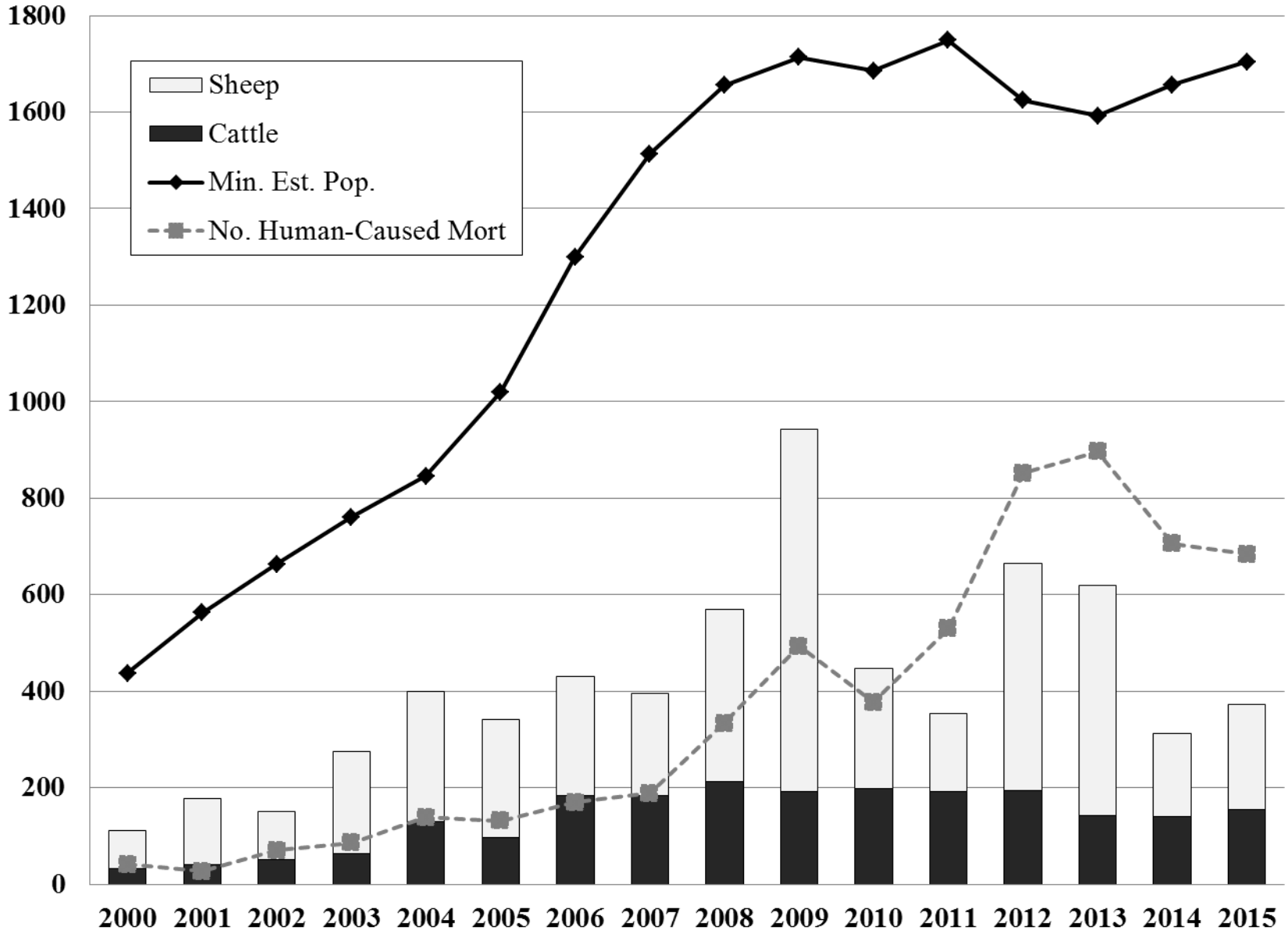
Wolf Social 'K' and Management




Northern Rocky Mountain Gray Wolf Population, 2015
61 of 358 (~17%) known NRM wolf packs that existed at some point in 2015 were involved in at least 1 confirmed livestock depredation (USFWS et al. 2016).
Wolf Packs
NRM Boundary
Highways
National Park Service
N
0 25 50 100
Miles
Washington
Oregon
Idaho
Montana
Wyoming
Spokane
Coeur d'Alene
Pullman
Lewiston
Clarkston
Colville
Monse
Mesa
Kennewick
Baker
Burns
Burns Junction
Boise
Twin Falls
Pocatello
Idaho Falls
Great Falls
Helena
Glasgow
Miles City
Sheridan
Cody
Gillette
Casper
Lander
Rock Springs
Laramie
Cheyenne
Salt Lake City


Bellingham
Seattle
Olympia
Wenatchee
Moses Lake
Spokane
Pullman
Clarkston
Kennewick
Walla Walla
Colville
Omak
Twisp
Ellensburg
Yakima
Beaver Creek
Wedge
Salmo
Smackout
Profanity Peak
Goodman Meadows
Dirty Shirt
Skookum
Carpenter Ridge
Nc'icn
Strawberry
Loup Loup
Lookout
Stranger
Whitestone
Huckleberry
Teanaway
Tucannon
3 of 20 (15%) known wolf packs in WA that existed at some point in 2015 were involved in at least 1 confirmed livestock depredation (Becker et al. 2016).
Wolf pack territories
WA wolf recovery regions
National Parks and Recreation Areas
Tribal Lands
0 10 20 40
Miles
N
Copyright © 2013 National Geographic Society, i-cubed

NRM Trends


1800
1600
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800
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200
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Sheep
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Min. Est. Pop.
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2000
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2011
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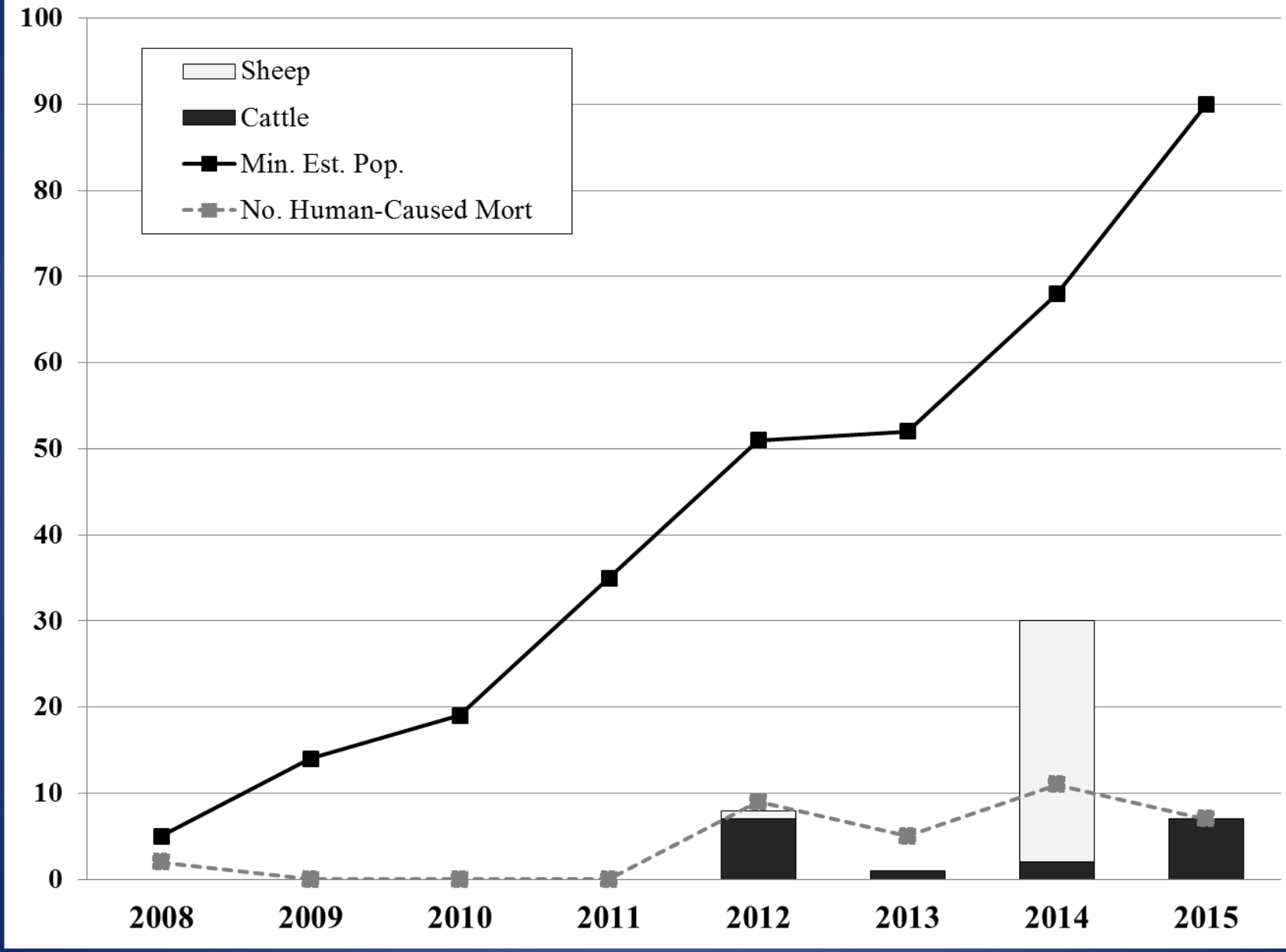
2013
2014
2015

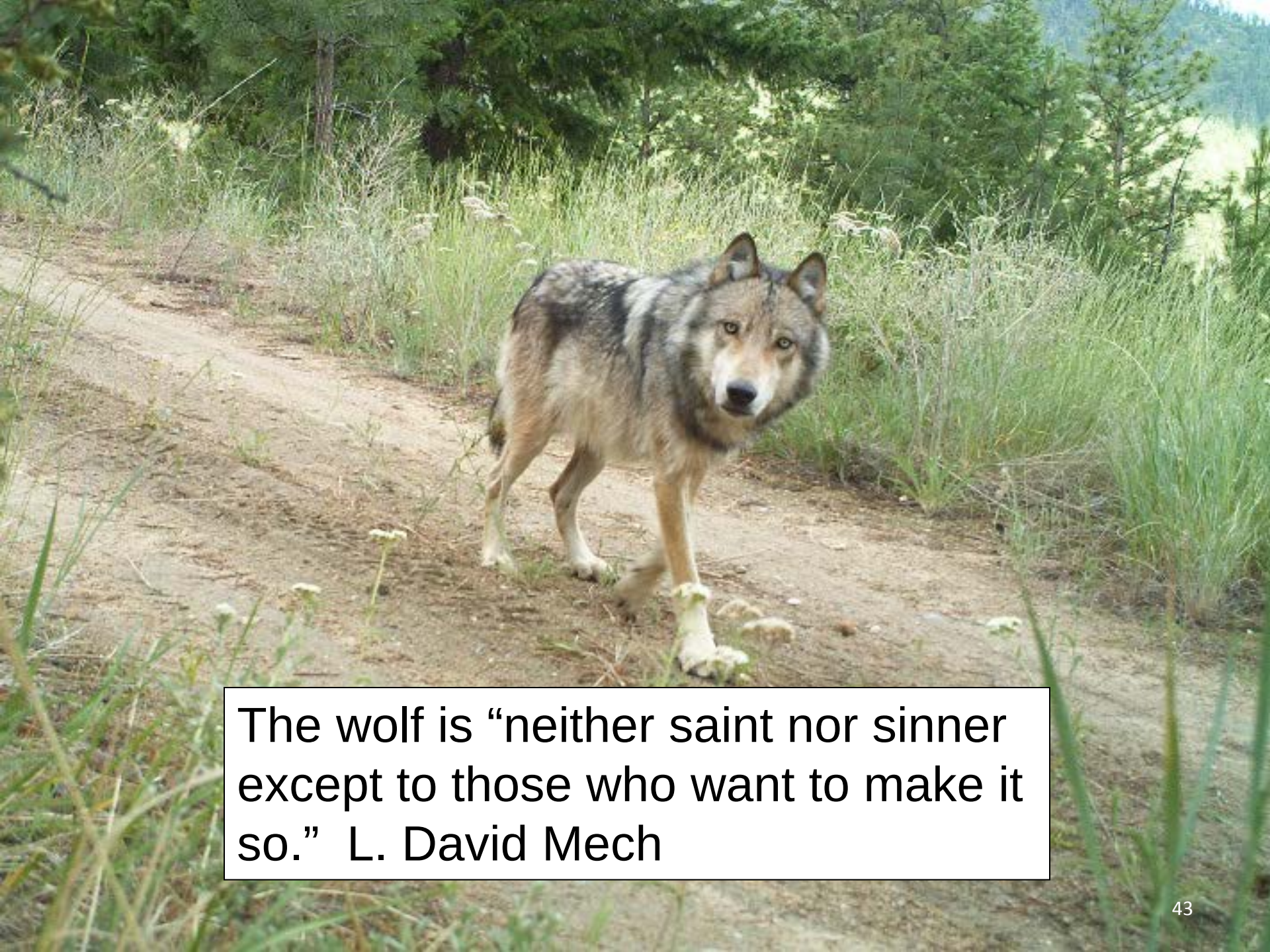
WA Trends


100
90
80
70
60
50
40
30
20
10
0
Sheep
Cattle
Min. Est. Pop.
No. Human-Caused Mort
2008
2009
2010
2011
2012
2013
2014
2015

Managing Gray Wolves

- Continue to normalize them – manage wolves as you would any other species
  - Just because a wolf did something does not make it a bigger deal than another critter doing it
- Manage the population, not the individual
  - Continue reviewing and contributing to best available science
  - Develop and implement consistent management strategies for the species

consistency → credibility → respect → trust



The wolf is “neither saint nor sinner except to those who want to make it so.” L. David Mech