



*A Scientific Review of Mountain Lion Hunting and its Effects*

## **Aggressive Trophy Hunting of Mountain Lions May Exacerbate Human Conflicts with Wildlife**

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# Abstract

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This report examines the science behind mountain lion trophy hunting in the western United States. Wildlife agencies claim this hunting helps control mountain lion populations and reduces conflicts with humans and livestock. Recent research suggests otherwise.

## The History of Mountain Lion Hunting

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Mountain lions were once abundant across North America, but widespread hunting drastically reduced their numbers by the 1960s. Since then, many states have allowed hunting them again, with quotas and regulations.

## The Science Behind Trophy Hunting

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There are three purported reasons why states allow trophy hunting of mountain lions:

1. Increase ungulate populations (deer and elk) for hunters
2. Reduce mountain lion conflicts with humans (public safety)
3. Reduce mountain lion conflicts with livestock and pets (depredation)

However, recent studies looking at actual data tell a different story:

- There's little evidence that trophy hunting significantly boosts deer and elk populations for hunters.
- Surprisingly, the studies show a positive association between trophy hunting and human-lion conflicts. In other words, hunting might actually increase these conflicts

## Why Might Hunting Increase Conflicts?

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Trophy hunters often target large, dominant males. This disrupts the social structure of mountain lion populations. Younger, less experienced males take over the vacated territories. These younger males may be more likely to attack livestock or even people because they:

- Have less knowledge of their territory and prey availability.
- Face more competition from other males.

## California's Different Approach

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California banned trophy hunting of mountain lions in 1972. Instead, the state manages conflicts with non-lethal methods like hazing and relocation. California's approach seems to be working:

- It has a healthy mountain lion population.
- Its depredation rates (attacks on livestock) are similar to states with trophy hunting.

## The Importance of Apex Predators

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Mountain lions play a crucial role in the ecosystem. They help keep prey populations healthy by:

- Removing sick and weak animals (“predator cleansing”).
- This can help slow the spread of diseases like Chronic Wasting Disease (CWD) in deer and elk herds.

## Conclusions

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- Trophy hunting of mountain lions may not achieve the goals wildlife agencies claim.
- It might even increase human-lion conflicts.
- States should consider alternative, non-lethal management strategies like California's approach.
- Protecting mountain lions benefits the overall health of the ecosystem.

### Additional Information

The article also includes details about the scientific studies reviewed and figures illustrating the concepts discussed.

# Background

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Western state wildlife agencies, such as Colorado Parks and Wildlife, as well as trophy hunting organizations and other like-minded groups, attempt to link two key social benefits to their practice of trophy hunting of mountain lions:

- Growing wild ungulate populations to increase sport-hunting opportunities for deer and elk
- Reducing mountain lion conflicts with humans (public safety) and livestock or pets (depredation)

Historically, mountain lions, the fourth largest felid species globally, had the broadest geographic range of any North American mammal. However, [widespread and uncontrolled persecution and bounty hunting](#) of lions driven by human fear and protection of livestock from predation greatly reduced their geographic distribution and population by the 1960s. For example, in Colorado until 1965, mountain lions were considered a “varmint” with a \$50 bounty. The allowance of hunting lions with dogs—a practice generally forbidden for deer and elk hunting—is a present embodiment of anti-predator sentiments that have guided state fish and wildlife agencies for decades.

Wildlife agencies in 12 of 14 Western states with extant lion breeding populations (including Colorado in 1965) chose to manage these large cats as “big game animals” (i.e., large wild animals hunted for sport or food) beginning in the 1960s and 1970s, imposing long hunting seasons and permissive methods of take. Even with modest limits on killing, lions began to make a comeback in the West, moving from extirpated or endangered status to non-endangered.

That said, wild mountain lion population numbers are [notoriously difficult to reliably estimate](#) as these large cats are elusive and wide-ranging across diverse habitats. There has never been a widespread status review of lion numbers throughout their range in the West. It is guesswork, but it’s thought there may be 30,000 mountain lions in 14 Western states: Arizona, California, Colorado, Idaho, Montana, North Dakota, Nevada, New Mexico, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.

About 3,500 to 4,000 mountain lions per year are killed by trophy hunters in our Western states. In Colorado, the CPW quota allotted for mountain lion trophy hunting from late November 2023 through April 2024 was 664 animals. In recent years, about 500 lions, a slight majority of them adult males, have been killed by trophy hunters annually in Colorado.

The two Western states where mountain lions are not classified as “big game animals” are:

Texas, where mountain lions are considered a nuisance species, are unprotected, and can be hunted without a license, bag limit, or reporting requirement.

California, where lions have been fully protected from sport hunting since 1972 and managed through re-location, non-lethal deterrence, or (rarely) [killing of lions that threaten public safety, livestock, or the federally endangered CA bighorn sheep](#).

It is important to note that mountain lions also live across the Americas. They are hunted in a number of Canadian provinces, but only in Mexico and Peru in Central and South America. They are protected from trophy hunting in 24 of 28 nations, with Argentina permitting hunting of “conflict” pumas.



# Methodology & Findings

The [North American Model of Wildlife Conservation](#) is a widely utilized set of seven principles or tenets that guide wildlife protection and management in the United States and Canada. Tenet No. 6 states “Science is the proper tool for discharge of wildlife policy.”

“Science” can be defined as a method for determining what is true, such that science forms an evidentiary basis for action and policy because of its power to predict. Truth in science, it is said, is determined by the collective judgment and agreement of the scientific community. In other words, scientific truth can be defined by “replicability” (i.e., obtaining consistent results across studies aimed at answering the same scientific question using new data or other new computational methods).

Using replicability as a metric for “scientific truth,” we searched the recent (past decade) peer-reviewed and primary (non-review) scientific literature to assess the validity of the three main justifications for mountain lion hunting.

We emphasized field studies that examined the relationship between rates of lion trophy hunting and rates of human conflict with lions, likely the most cited rationale by pro-trophy hunting advocates.

We identified four recent primary (non-review) field-based observational scientific research papers that addressed these issues:

1. Peebles KA, Wielgus RB, Maletzke BT, Swanson ME, 2013. Effects of remedial sport hunting on cougar complaints and livestock depredations. [PLoS ONE 8\(11\):e79713](#).  
*Read more [here](#).*
2. Teichman K, Cristescu B, Darimont CT (2016). Hunting as a management tool? Cougar-human conflict is positively related to trophy hunting. [BMC Ecol 16:44](#).  
*Read more [here](#).*
3. Dellinger JA, Macon DK, Rudd JL, Clifford DL, Torres SG (2021). Temporal trends and drivers of mountain lion depredation in California, USA. [Human-Wildlife Interactions. 15\(1\):21](#).
4. Laundré JW, Papouchis C (2020). The Elephant in the room: What can we learn from California regarding the use of sport hunting of pumas (*Puma concolor*) as a management tool? [PLoS ONE 15\(2\):e0224638](#).  
*Read more [here](#).*

**“Ecology is not rocket science; it is much more complicated than that.”**

*– Marine biologist Peter Sale, 2017*

# The Four Papers: Main Findings

These published peer-reviewed studies in western U.S. & Canada show the failure of trophy hunting to decrease human-mountain lion conflict



- There is little to no evidence that trophy hunting of mountain lions either significantly increases deer and elk hunting opportunities for sportsmen/women (Laundré & Papouchis 2022) or reduces mountain lion conflicts with people (public safety) and livestock or pets (depredations), a conclusion of all four papers.
- Counter-intuitively, this field-based observational research across all four studies in multiple Western states concluded that trophy hunting of mountain lions exacerbates and worsens human-lion conflict (i.e., there was a positive association between mountain lion hunting and human conflict reports the following year). The mechanism appears to be that trophy mountain lion hunting destabilizes mountain lion social-, territorial- and age-sex structures.
- Trophy hunters often target the largest and most dominant individuals, which are usually older males. This alters the age structure of exploited lion populations, creating vacancies in the previously occupied territories and allowing younger and less experienced subadult males to take over territories. These conditions may all promote conflicts with people. Younger males may be more likely to attack livestock or humans, as they have less knowledge of their territory and prey availability and may face more competition from other males.
- We found no recent field-based research reports in the peer-reviewed literature that describe a negative correlation between mountain lion trophy hunting and human-lion conflict reports.

**“The great tragedy of science — the slaying of a beautiful hypothesis by an ugly fact.”**  
– *Anthropologist-biologist Thomas Huxley, 1870*



**Table 1A: In Study No. 1, the no. of mountain lions killed by trophy hunting in the previous year was positively associated with increased depredation & conflict**

Study 1	Location, goal & design	Data, analysis & findings	Conclusions & comments
<p><b>Peebles et al 2013.</b> Effects of remedial sport hunting on cougar complaints and livestock depredations. <i>PLoS ONE</i>. 8(11): e79713. <a href="https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0079713">https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0079713</a></p> <p><b>Comments:</b> Cougars inhabit approx. 61% of WA state land mass.</p> <p><i>Depredation</i> are attacks on or killing of domestic livestock &amp; pets (cats or dogs) as confirmed by WDFW.</p> <p><i>Remedial sport hunting</i> is practice of increasing hunting of predators to reduce their population &amp; associated human complaints &amp; livestock depredations.</p>	<p><b>Location:</b> Washington state</p> <p><b>Goal:</b> Assess effects of remedial sport hunting on reducing cougar complaints &amp; livestock depredations in WA from 2005 to 2010 (6 years). Remedial sport hunting is a practice of hunting predators to reduce their population and the associated human complaints &amp; livestock depredations.</p> <p><b>Design:</b> Large-scale (statewide) long-term (6 year) observational study. The no. of complaints, livestock depredations, lions harvested, estimated lion populations, human population &amp; livestock populations were calculated for all 39 counties &amp; 136 GMUs (game management units) in WA</p> <p><b>Hypothesis:</b> Investigators tested the widely accepted idea that increased sport hunting will decrease cougar complaints &amp; lion depredations in an observational study.</p> <p>The “<b>remedial hunting</b>” hypothesis predicts that lion complaints &amp; livestock depredations will decrease after increased sport hunting.</p> <p>The “<b>source-sink</b>” hypothesis predicts that lion complaints &amp; livestock depredations will remain stable or increase after increased sport hunting.</p>	<p><b>Data:</b> The following information was calculated for all 39 counties &amp; 136 GMUs in WA for each year from 2005 to 2010:</p> <p><b>Independent (explanatory) variables:</b></p> <ul style="list-style-type: none"> <li>- No. of people; No. of cougars; No. of hunter harvested cougars (n=1,068);</li> <li>- No. of small &amp; large livestock.</li> </ul> <p><b>Two response (dependent or outcome) variables:</b></p> <ul style="list-style-type: none"> <li>- Number of verified cougar complaints (n=432);</li> <li>- No. of verified livestock depredations (n=166) &amp; no. of pet depredations (n=41)</li> </ul> <p>- Data dominated by hunting mortalities (n = 7550) w/ conflict-related kills less frequent (n = 1238). Dataset had more male (n = 5348) than female records (n = 3440).</p> <p><b>Main analysis:</b> Negative binomial generalized linear models tested the expected negative relationship between the no. of verified lion complaints &amp; no. of lion depredations in the current year (for both response variables) w/ the no. of lions harvested in the previous year.</p> <p><b>Results:</b> As expected, lion complaints &amp; depredations were positively associated w/ human population, livestock population &amp; lion population. <b>Contrary to expectations</b>, lion complaints &amp; depredations were most strongly associated <b>w/the number of lions harvested the previous year.</b></p> <ol style="list-style-type: none"> <li>1) The odds of lion complaints &amp; livestock depredations increased dramatically (36% to 240%) w/increased lion harvest the previous year.</li> <li>2) For each 100% increase in adult lion harvest, the odds of a verified complaint the following year increased by 160%. For each 10% increase in lion harvest, the odds of a verified complaint increased by 16%.</li> <li>3) Effect of lions harvested the previous year on odds of verified complaints is <b>10 times higher (1.36 vs 1.03) vs. effect of no. of cougars in the landscape.</b></li> <li>4) For each adult lion harvested, the odds of a depredation occurring the following year increased by 50%.</li> <li>5) Livestock losses rose annually in correlation w/ the no. of lions taken by hunters but only in counties that experienced changed cougar demography.</li> </ol>	<p>Hunting of cougars had the greatest effects on lion depredations &amp; complaints, but not as expected.</p> <p>Remedial hunting of lions in WA was associated <b>w/increased, not decreased lion complaints &amp; depredations</b>. This supports the <b>source-sink hypothesis</b>.</p> <p>Very heavy hunting (eg 100% removal of resident adults in 1 year) increased the odds of lion complaints &amp; depredations in year 2 by 150% to 340%.</p> <p>Widespread indiscriminate hunting does not appear to be an effective preventative &amp; remedial method to reduce predator complaints &amp; livestock depredations.</p> <p><b>Note:</b> Increased trophy hunting fails to account for compensatory immigration &amp; the shift in the sex-age structure towards younger male cougars which may be responsible for the increased reports of depredations.</p> <p>The investigators suggest that increased young male immigration, social disruption of lion populations &amp; associated changes in space use by lions caused by increased hunting resulted in more complaints &amp; livestock depredations.</p>

**Table 1B: In Study No. 2, the no. of lions killed by trophy hunters in the current & previous year was positively associated with increased human-lion conflict**

Study 2	Location, goal & design	Data, analysis & findings	Conclusions & comments
<p><b>Teichman et al 2016.</b> Hunting as a management tool? Cougar-human conflict is positively related to trophy hunting. <i>BMC Ecology</i>. 16, 44 <a href="https://bmcecol.biomedcentral.com/articles/10.1186/s12898-016-0098-4">https://bmcecol.biomedcentral.com/articles/10.1186/s12898-016-0098-4</a></p> <p><b>Comments:</b> Vancouver Island is also called “VanCougar” BC as it is the world’s ‘hotspot’ of cougar-human conflict <a href="https://vancouverguardian.com/vancouver-island-cougar/">https://vancouverguardian.com/vancouver-island-cougar/</a></p> <p>Vancouver Island has the highest concentration of cougars in the world w/ est. population of 600 to 800. The island has a land area of 31,285 km<sup>2</sup> <a href="https://www.nsnews.com/in-the-community/this-bc-island-has-the-highest-concentration-of-cougars-in-the-world-3124721">https://www.nsnews.com/in-the-community/this-bc-island-has-the-highest-concentration-of-cougars-in-the-world-3124721</a></p> <p>Cougars thrive via abundance of black-tailed deer on the island. Black-tailed deer are a subspecies of mule deer.</p>	<p><b>Location:</b> British Columbia (BC), Canada including Vancouver Island</p> <p><b>Goal:</b> To challenge the commonly accepted but under-examined assumption that hunting large carnivores decreases predator-human conflict</p> <p><b>Objectives:</b> (1) To determine whether cougar trophy hunting and conflict incidence mortality are related &amp; (2) To test if cougars killed by hunters are larger than those that came into conflict with people.</p> <p><b>Design:</b> Observational. Authors analyzed a 30-year (1979-2008) data set on hunter-caused &amp; conflict-associated cougar mortality across five regions in British Columbia, Canada, including Vancouver Island.</p> <p><b>Hypothesis:</b> <i>Young animal hypothesis</i> – high hunter mortality leads to young animals (esp males) becoming involved in conflict.</p>	<p><b>Data:</b> Records of mountain lion kills by BC resident hunters &amp; non-resident guided hunters (<math>n = 3219</math>) as well as conflict-related cougar deaths (<math>n = 449</math>). Lion age estimated by skull size measurements.</p> <p><b>Main analysis:</b> Multiple linear regression modeling. <b>Outcome variable:</b> Cougar conflict incidence per 10Km<sup>2</sup> Conflict defined as any incident of cougar road mortality, predation on livestock, perceived risk to people e.g. cougars sighted in urban areas, or recorded attack on humans. <b>Predictor variables:</b> Human density (D), human hunting pressure (annual no. of lions hunted per 10km<sup>2</sup>) in year of conflict (<math>H_0</math>); Normalized Difference Vegetation Index (NDVI; a proxy for plant and prey productivity) in year of conflict. Separate analysis for each of five regions of British Columbia, CAN</p> <p><b>Results:</b></p> <ol style="list-style-type: none"> <li>1 - A consistent regional-scale pattern revealed that trophy hunting pressure on lions was associated w/ increased lion-human conflict.</li> <li>2 - Lions that came into conflict with humans were younger vs those killed by trophy hunters</li> <li>3 - Human hunting pressure <b>during or before the year of conflict</b> were associated with increased male cougar-human conflict &amp; were the most important predictive variables.</li> <li>4 - In all five regions assessed, cougar conflict was higher with increased human hunting pressure for at least one cougar sex.</li> <li>5 - Human hunting pressure in <b>both current and lagged periods had the most relative importance for predicting cougar-human conflict</b> for male cougars across the five regions.</li> <li>6 - Human hunting was positively associated male cougar conflict</li> <li>7 - Overall, increased human hunting was related to greater conflict for 16 of 17 models that included hunting variables</li> </ol>	<p>Hunting of cougars is often associated with increases - not decreases - in mountain lion-human conflict.</p> <p>This study’s patterns over large geographic &amp; temporal scales suggest that <i>alternative approaches to conflict mitigation than hunting</i> might yield more effective outcomes for humans as well as cougar populations &amp; the individuals within populations.</p> <p>Hunting provides a poor &amp; often counter-productive method for managing conflict with large predators. Although these results are correlative, the authors caution against the universal use of hunting as a tool for managing conflict with large apex predators such as mountain lions.</p> <p>This study supports the <i>young animal hypothesis</i> ie that high hunter mortality leads to young lions getting into conflict w/ people, domestic animals &amp; pets. Trophy hunters primarily target the biggest individuals in a population. When adult resident cougars are consistently killed by hunters, it <b>can disrupt cougar reproductive strategies, dispersal patterns and social structure</b> e.g. when a resident cougar is removed from his territory, it creates openings for multiple conflict-prone dispersing sub-adult males to claim vacant territories, thereby potentially exacerbating cougar-human conflict.</p> <p><b>Note:</b> This blog is a simplified explanation of this study by the lead author: “<i>Trophy hunting - unexpected consequences for cougar-human conflict</i>” <a href="https://blogs.biomedcentral.com/bmcseriesblog/2016/10/27/trophy-hunting-unexpected-consequences-cougar-human-conflict">https://blogs.biomedcentral.com/bmcseriesblog/2016/10/27/trophy-hunting-unexpected-consequences-cougar-human-conflict</a></p>



**Table 1C: Study No. 3, the no. of mountain lions removed due to human conflict the previous year was positively associated with increasing lion depredation**

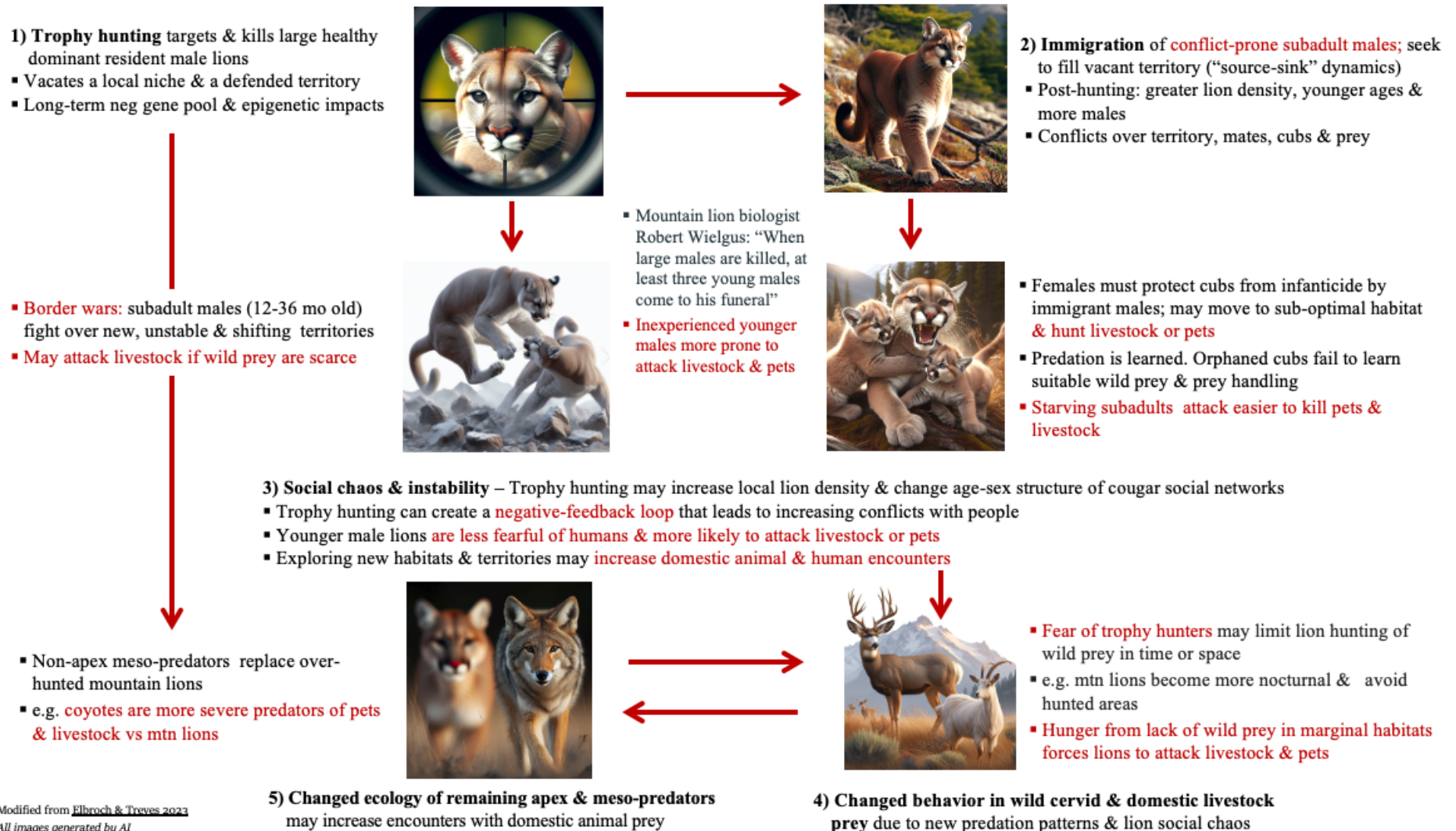
Study 3	Location, goal & design	Data, analysis & findings	Conclusions & comments
<p><b>Dellinger et al 2021.</b> Temporal trends and drivers of mountain lion depredation in California, USA. <i>Human-Wildlife Interactions</i> 15(1):162–177, Spring 2021  <a href="https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1712&amp;context=hwi">https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1712&amp;context=hwi</a></p> <p><b>Comments:</b>            Half of the CA landscape is suitable as mountain lion habitat.</p> <p>Mtn lion population mgmt. in CA has varied widely over past 100 plus years, ranging from a bounty system (1906–1963) to specially-protected status (1972–present)</p> <p>Uniquely in CA, lions are managed only in the context of human-large carnivore conflict (ie public safety or depredations) <i>without trophy hunting</i>. Offending mtn lions can be lethally removed during a 10-day period via CDFW permit</p> <p>Out of 13 western States w/ breeding mtn lion populations, CA is the only state that bans lion hunting (since 1972). In 1990, CA citizens voted into law Proposition 117 to make mtn lions specially protected.</p>	<p><b>Location:</b> California</p> <p><b>Goal:</b> To examine temporal trends (increasing / decreasing /stable) in mtn lion depredations as well as factors influencing annual depredation rates at the county level from 1972 to 2019.</p> <p><b>Design:</b> Observational time series</p> <p><b>Hypothesis:</b> Increasing depredation rates would:            (1) Be highest at intermediate human densities (quadratic &amp; (2) Have a positive linear association w/:</p> <ul style="list-style-type: none"> <li>- Increasing amount of suitable lion habitat &amp; habitat quality</li> <li>- No. of hoof stock present in ag operations &amp;</li> <li>- No. of mountain lions removed the previous year</li> </ul> <p><b>Rationale:</b> California can serve as a “control” for trophy hunting-free mtn lion mgmt vs the 12 other Western states that permit lion trophy hunting.</p>	<p><b>Data:</b> County-level CDFW mtn lion depredation data over 48 years (1972 to 2019) for all 58 CA counties including 7,719 confirmed lion depredations of domestic animals; includes 3,394 individual lions lethally removed. Used to derive 1,456 annual depredation rates by county from 1972 to 2019</p> <ul style="list-style-type: none"> <li>- Depredations grouped as <i>pets</i> (dogs, cats, poultry; n=802); <i>small hoofstock</i> (pigs, goats, llamas &amp; sheep; n=4,718) &amp; <i>large hoofstock</i> (cattle &amp; horses; n=1,013).</li> <li>- Bounty killing records from 1907 to 1963 for 12,580 mtn lions purposely removed to protect domestic animals &amp; promote wild cervids.</li> </ul> <p><b>Main analysis:</b> Poisson regression modeling to test hypothesis (1); linear regression modeling to test hypothesis (2).</p> <p><b>Outcome (dependent) variable:</b> Mtn lion depredations by year &amp; county for pets, small- &amp; large-hoofstock;</p> <p><b>Independent (predictor) variables (by year &amp; county):</b> Amount of suitable lion habitat (km<sup>2</sup>); No. of animals in ag production per km<sup>2</sup>; No. of mtn lions removed previous year; Human density per km<sup>2</sup>; No. of mtn lions bountied per county from 1906 to 1963 (proxy for lion habitat quality)</p> <p><b>Results:</b></p> <ol style="list-style-type: none"> <li>1 - Mtn lion depredations were positively associated w/ no. of mtn lions lethally removed the previous year in a county. <i>Depredation rates increased 9% for every mtn lion removed on a depredation permit the previous year.</i></li> <li>2 - Human density &amp; agricultural productivity were negatively associated with increasing lion depredation rates</li> <li>3 - Amount of suitable habitat was positively associated w/ increasing depredation rates</li> <li>4 - Increase in annual overall no. of mtn lion depredations &amp; for each type of domestic animal over time from 1972 to 2019</li> <li>5 - Smaller-sized hoofstock operations in areas of suitable mountain lion habitat are key factors in predicting mountain lion depredations in CA</li> </ol>	<p>The permanent removal of offending individual lions appears to increase the potential for conflict in the next year.</p> <p>Confirms <b>Peebles et al 2013</b> (Study No. 1) and <b>Teichman et al 2016</b>. (Study No. 2). <b>“Proof” in science is determined by repeatability of findings in different settings or conditions</b></p> <p>This work points to presence &amp; quality of <b>mtn lion habitat &amp; wildlife mgmt actions</b> as primary drivers predicting lion depredation.</p> <p>CA mtn lion depredations increased over time &amp; most often associated w/ small hoofstock (esp sheep &amp; goats) &amp; pets.</p> <p><b>Note:</b> The positive relationship between no. of lions lethally removed one year &amp; increased depredations the next year seems counter-intuitive. However:</p> <ul style="list-style-type: none"> <li>- Lethal resident adult removal creates vacancies &amp; increases subadult male migration</li> <li>- Removals may create a <b>negative-feedback loop</b> leading to increasing conflict &amp; even more lethal removals.</li> <li>- Maintaining an older lion age structure by reducing lethal removal of resident adults could mitigate depredations</li> <li>- Improving husbandry for pets &amp; small hoof-stock living in areas occupied by mtn lions may be the most effective way to reduce human–predator conflicts in CA &amp; elsewhere</li> </ul>

**Table 1D: Study No. 4, CA without mountain lion trophy hunting had a lower rate of lion-human conflicts than eight of ten Western states with lion trophy hunting**

Study 4	Location, goal & design	Data, analysis & findings	Conclusions & comments
<p><b>Laurdré &amp; Papouchis 2020.</b> The Elephant in the room: What can we learn from California regarding the use of sport hunting of pumas (<i>Puma concolor</i>) as a management tool? <i>PLoS ONE</i> 15(2): e0224638. <a href="https://doi.org/10.1371/journal.pone.0224638">https://doi.org/10.1371/journal.pone.0224638</a></p> <p><b>Comments:</b> Mtn lion mgmt in the western U.S. is highly contentious, especially regarding use of trophy hunting as a wildlife mgmt tool.</p> <p>In the 1970's, mountain lions were reclassified as game species in ten of 12 western states where lions still occurred &amp; sport hunting was established. This provided some lion protection via closed seasons &amp; bag limits vs. previous decades of unrestricted lion bounty hunting.</p> <p>The two exceptions are <i>Texas</i> where mtn lions are unprotected &amp; can be hunted w/o license or limit, &amp; <i>California</i> where lions are fully protected from sport hunting &amp; managed thru relocation, non-lethal deterrence, or killing of lions that threaten public safety, livestock or the endangered CA desert bighorn sheep.</p> <p>From 2000 to 2015, total mtn lion mortality in 10 trophy hunting states remained at <b>300-400 lions</b> per state per year w/ from sport hunting. CA lions killed were consistently lower (<b>&lt;150 lions/year</b>) vs. 10 trophy hunting states.</p>	<p><b>Location:</b> Eleven Western U.S. States w/ breeding mountain lion populations: AZ, CA, CO, ID, MT, NV, NM, OR, UT, WA &amp; WY</p> <p><b>Goal:</b> The wildlife mgmt rationale for mtn lion trophy hunting is that it provides recreational hunting &amp; also reduces threats to human safety &amp; livestock depredation &amp; increases deer &amp; elk populations, the lion's main prey. An increasing no. of scientific studies question if sport hunting meets these agency mgmt objectives.</p> <p><b>Design:</b> Comparative observational study of agency mtn lion mgmt claims in ten states that permit lion trophy hunting vs CA (as hunting-free control) w/ a 2000 to 2015 time-frame focus.</p> <p><b>Hypotheses:</b> Mountain lion trophy hunting will: 1 - Suppress mountain lion populations; 2 - Reduce problematic lion-human encounters; 3 - Reduce lion predation on domestic livestock; 4 - Reduce impact of lion predation on wild ungulate numbers resulting in increased sport hunting opportunities of elk &amp; deer.</p> <p><b>Rationale:</b> If sport hunting is achieving the mgmt goals of state wildlife managers, then CA w/o a lion trophy hunt should have: 1 - higher lion population densities; 2 - higher per-capita problematic lion-human conflicts 3 - greater lion predation on domestic sheep &amp; cattle; &amp; 4 - higher levels of lion predation on wild ungulates results in lower deer sport hunting opportunities</p>	<p><b>Data:</b> Analyzed data was not collected by the authors but was collated from various open access files of state &amp; federal agencies w/ lion mgmt control for all eleven states including: 1 - Estimated mountain lion abundance 2 - Number of lions killed yearly by sport hunters &amp; other causes of mortality 3 - Estimated deer populations 4 - Estimated deer killed yearly by hunters 5 - Estimated no. of livestock, cattle &amp; sheep 6 - Estimated no. of livestock, cattle &amp; sheep killed by mountain lions 7 - Estimated number of mountain lion-human incidents (conflicts) for each state</p> <p><b>Main analysis:</b> Data from all 11 states was standardized. CA data was then statistically compared to equivalent data from the ten states w/ lion trophy hunts. Comparisons focused on the recent 15 years of intense mtn lion management (2000-2015).</p> <p><b>Results:</b> Compared to 10 Western states where lions are trophy hunted, CA had 1 - Similar mtn lion densities; 2 - The 3<sup>rd</sup> lowest per capita problematic mtn lion-human encounters; 3 - Similar per capita loss of cattle &amp; significantly lower loss of sheep; 4 - Similar average deer densities w/ annual changes in deer populations similar to changes in the other 10 states</p>	<p>There is <i>no evidence</i> that mountain lion trophy hunting has produced the mgmt outcomes sought by wildlife managers beyond providing a sport hunting opportunity.</p> <p>Because other research suggests that <i>trophy hunting exacerbates conflicts between mountain lions &amp; people</i> (eg Peebles et al 2013 (Study No. 1), Teichman et al 2016 (Study No. 2), Dellinger et al 2021 (Study No. 3), the authors recommend that <i>state agencies re-assess the use of trophy hunting as a mtn lion mgmt tool.</i></p> <p><b>Note:</b> The primary mgmt objective for lion sport hunting in the ten western states was usually to set "bag limits" similar to historic bounty kill levels, which, regionally, never exceeded 1,000 animals per year.</p> <p>However, by 2016, the 10-state average kill rate of lions was 390 per state or over 3,900 lions per year; <b>&gt;89% were killed by sport hunters</b> &amp; the rest for specific threats to human safety, livestock depredation or accidents. <a href="https://www.eastoregonian.com/sports/outside/study-evidence-does-not-support-hunting-as-way-to-control/article_ba7bfd56-5827-11ea-a59a-4bae963d6dc2.html">https://www.eastoregonian.com/sports/outside/study-evidence-does-not-support-hunting-as-way-to-control/article_ba7bfd56-5827-11ea-a59a-4bae963d6dc2.html</a></p>



# Figure 1: Mountain lion trophy hunting increases risks of human-lion conflicts





## Figure 2: Human-mountain lion conflict in wild, rural, & suburban Colorado



### Sport recreation for lion trophy hunters

- In 2022, 2,165 resident & 506 non-resident licenses sold in Colorado; **486 lions killed**
- Just **four out of every 10,000** of CO's 5.84M residents bought a mtn lion license in 2022
- Miniscule lion license revenues of ~\$280K per year for Colorado Parks & Wildlife = **0.14%** of \$200 million CPW annual budget
- Modest to large incomes for allied game industries e.g. guns, lodging, guides & outfitters e.g. **“guaranteed lion kill”** outfitted hound hunt costs \$6.5K to \$8K
- Small number of beneficiaries of the taking of this wild public natural resource



### Mountain lions may enter human suburban & exurban domains

- Lions may frighten or threaten people & their pets
- Lions are wary & avoid people.
- **Attacks on humans are rare.** Dogs (via bites) & deer (via vehicle collisions) injure & kill far more people vs lions



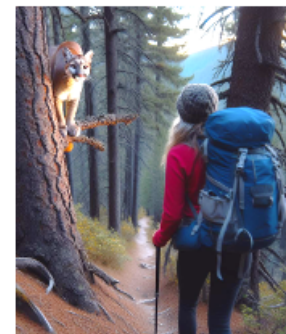
### Mountain lions compete with human hunters for wild ungulate prey especially deer & elk

- A mature lion must kill the equivalent of one adult deer every seven to twelve days to survive
- High human cervid harvests may pressure lions to prey on livestock
- **Lions w/ little interest in farm live-stock if wild deer & elk are abundant**



### Mountain lions may attack un-guarded or un-protected livestock

- Calves, sheep & goats at highest risk
- Ranchers & farmers should adopt **non-lethal deterrence** for human-lion co-existence e.g. guard dogs & hazing



### People entering Colorado's wild spaces may encounter mountain lions

- About 57% of state is suitable lion habitat
- Onus on people as visitors to lion's home to minimize their personal risk

*Images generated by AI*

## A note on the “California system”

Mountain lions are legally classified in California as a “specially protected species” in 1990 when voters approved a 1990 ballot measure and then affirmed the original vote in a subsequent plebiscite in 1996. Because it had no mountain lion trophy hunting over the previous 51 years, Laundré and Papouchis (2020) used California as a “control state” to compare outcomes within 10 Western states with trophy hunting of mountain lions. Laundré chose California for two reasons. First, it has had a thriving mountain lion population with no mountain lion hunting for the past half century. Second, its depredation rates, human-conflict reports, and cervid population density are quite similar to those in the Western states with trophy hunting as the “elephant in the room.” In other words, the mountain lion trophy hunting states know about the California system but they refuse to acknowledge California’s data or to adapt their lion management policies towards less trophy hunting.

Rather than managing mountain lions through regulated hunting, wildlife managers in California issue depredation permits to help manage lions. According to the California Fish and Game Code, a mountain lion depredation permit expires 10 days after issuance. However, the California Department of Fish and Wildlife policy requires landowners to try non-lethal means to deter mountain lions from attacking domesticated animals before requesting a lethal permit. Non-lethal methods used to discourage depredation by mountain lions include aggressive hazing that does not injure or kill the mountain lion. This includes the use of less-than-lethal ammunition (beanbags, rubber bullets, cracker shells, rock salt, paintballs), noise-making devices, pursuit with an all-terrain vehicle, and/or pursuit with dogs. If the hazing fails to keep the predators away, authorities consider other strategies, including trapping

and tagging the lions so that officials can alert landowners when threats are near.

California does have regulations allowing for the take (killing) of depredating mountain lions and for the removal of individual lions that are deemed a safety risk to people. However, only a mountain lion posing an imminent threat to human life may be killed for public safety. This is defined as a lion exhibiting one or more aggressive behaviors directed toward a person that is not reasonably believed to be due to the presence of responders. All situations that do not meet this threshold must be resolved with non-lethal force (hazing, tranquilizing, capturing, relocating, monitoring, etc.). From 2001 to 2019, an average of 186 depredation permits were issued resulting in an average of 89 lions killed per year (Table 2A). A report from California Fish and Wildlife stated that in 2021, 163 (90%) of the 182 mountain lion depredation permits issued in California were nonlethal. Another CDFW report stated that just 61 lions were killed in California for depredation between 2020 and 2022, an average of just 22 lions killed per year (Table 2B). In 2023, that number fell to 10 lions killed in the state. Note that this recent number of lions killed for depredation in California (~22 per year) is far below the average of 500 to 600 lions that might be killed if California had a trophy hunting season with participation levels that matched those in Colorado and other western states.

In brief, the California mountain lion experience is unequivocal in two primary messages:

- Mountain lion hunting is unnecessary to minimize human-lion conflicts.
- Non-lethal methods are effective at preventing mountain lion depredation.

**Table 2A: Mountain lion depredation permits & take, California, 2000-2019**

Years	No. of depredation permits issued	Lethal take (n lions killed for depredation)
2001-2019	3,726	1,784 (48%)
Avg per year	186.3	89.2
Range	132-334	57-125

Source: *California Dept of Fish & Wildlife*

**Table 2B: Mountain lion depredation permits & take, California, 2020-2022**

Year	No. of non-lethal depredation permits issued	No. of lethal depredation permits issued	Total no. of depredations permits issued (non-lethal & lethal)	Lethal take (No. of lions killed for depredation)
2020	189	100	289	48 (17%)
2021	167	16	183	3 (1.6%)
2022	166	18	184	10 (5.4%)

Source: *CDFW*



# Conclusions

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The success of CPW and several other Western state wildlife agencies in the managed recovery of mountain lion populations over the past 50 years should be lauded and gratefully acknowledged as an important apex predator and ecosystem conservation success story.

However, CPW and other state wildlife agencies' current justifications for trophy hunting of mountain lions are based on the hypotheses that the killing of lions by hunters will suppress lion numbers and reduce undesirable lion impacts on human safety, livestock, and ungulate populations. *These hypotheses are not supported by recent scientific evidence.*

Scientific evidence using field data from multiple sources shows that none of CPW's mountain lion management goals, other than creating trophy hunting opportunities for a tiny wealthy sliver of the hunting population, are achieved with the current lion management policies.

Under [adaptive management](#) (where wildlife management learns from previous actions and adjusts future actions accordingly) and [ecosystem management](#) (the holistic approach to wildlife management that considers interactions and interdependencies among all components of an ecosystem, including the top-down benefits of an intact apex predator guild), state fish and wildlife agencies in the West need not permit trophy hunting of lions for either population control or reduction of human-lion conflict. If they permit the seasons, they should understand that they are allowing for lethal recreational activities and that this form of population exploitation may exacerbate human-wildlife conflicts. California has shown that non-lethal mountain lion management is largely effective for mountain lion-human co-existence.

[“Predator cleansing”](#) refers to the phenomenon of predators killing and removing the sickest and weakest individuals from prey populations, thereby improving the overall health and fitness of the prey. **In contrast to natural predators, who typically take the “newly born or the nearly dead,” trophy hunters generally favor killing large dominant males and large female lions, although judging size or age is very difficult for even the most experienced hunter.**

Predator cleansing can have various beneficial ecological and evolutionary effects, such as reducing the spread of diseases, maintaining genetic diversity, and stabilizing population dynamics. Notably, human deer and elk hunters avoid these same unhealthy deer and elk that are targeted by large apex carnivore predators. *The fewer apex predators removed by trophy hunters, the greater will be the natural “cleansing” benefits of apex predators on their cervid prey.* See **Figures 3, 4, and 5** below.

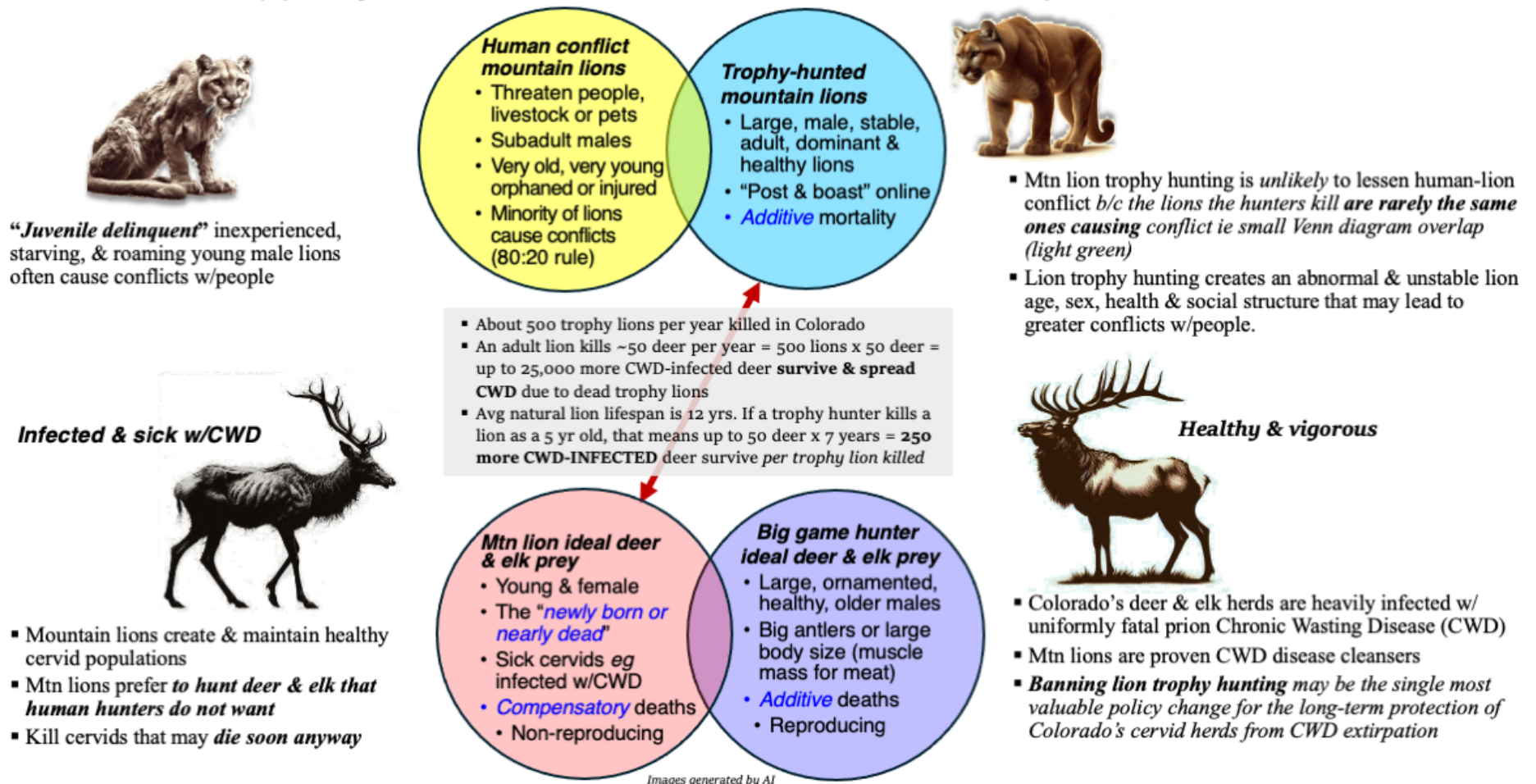
The deer and elk herds of Colorado (in particular) along with cervid herds in most western and intermountain states with breeding mountain lion populations are moderately to heavily infected with the uniformly fatal, slowly but progressively spreading, and potentially zoonotic prion infection [Chronic Wasting Disease](#) (CWD). The rates of cervid infection are highest in areas where lions are not present or rarely present, and they are lowest in habitats with higher rates of occupancy of suitable habitat. This prion disease, according to some models, [may cause the collapse and even extirpation of deer and elk populations](#) from some locations within the next few decades, including Colorado. Apex- and meso-carnivore predators, including [mountain lions](#), [wolves](#), and [bobcats](#), are perhaps [our best defense and offense](#) against this endemic and epidemic cervid prion disease.

These four papers all have flaws, as do all scientific research papers. However, despite different study populations and states, the essential conclusions were the same: Mountain lion hunt-

ing does not reduce human-lion conflicts or depredations of pets or livestock.

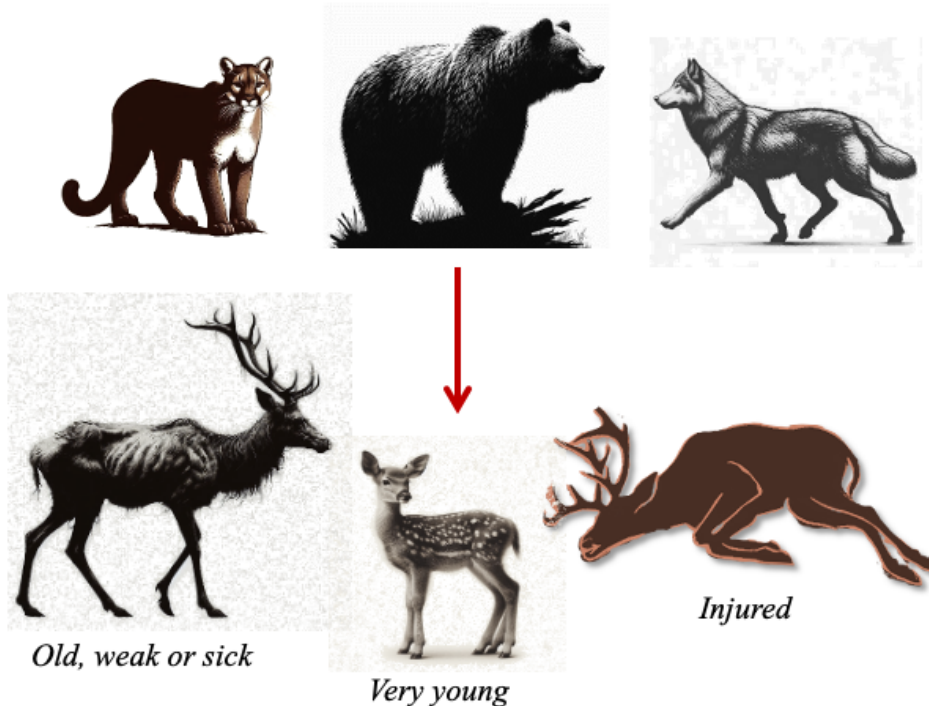
### Figure 3: Trophy hunting of mountain lions results in higher incidence of CWD in cervids and fewer healthy cervids for hunters

Trophy hunting of mountain lions leads to more & more CWD in deer & elk & fewer healthy cervids for hunter harvest



## Figure 4: Predator “cleansing” of diseased or weakened prey vs. human trophy hunting

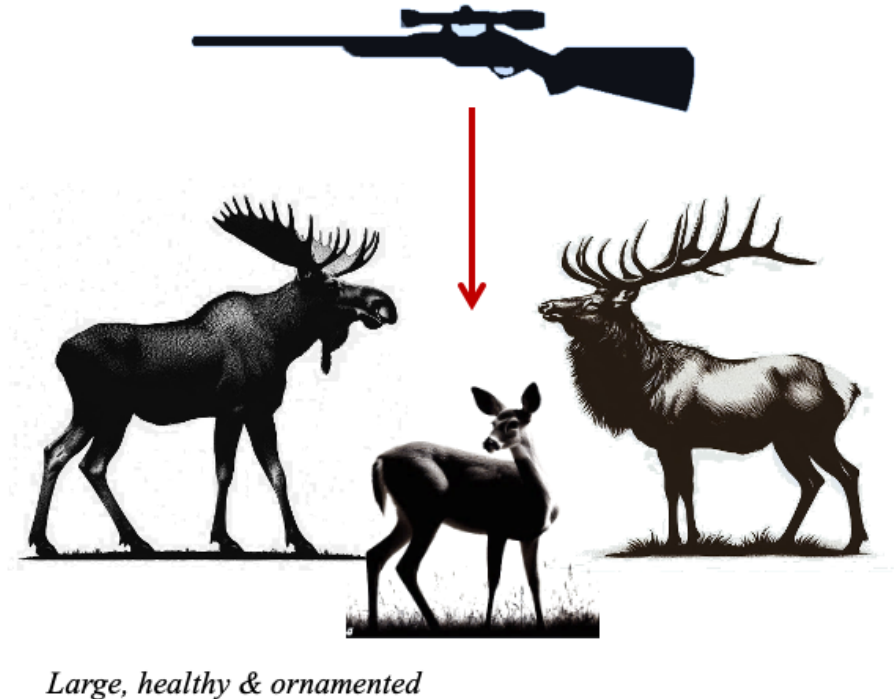
**Apex predators** – target **sick, weak, injured, very young, very old or otherwise vulnerable deer or elk** that are easiest to kill without injuring the predator



**Outcome – Healthier** cervid populations

- *Survival of the fittest cervids*

**Trophy hunters** – select **healthy young deer** for venison (meat) & **large healthy antlered adult males**; avoid obviously sick deer



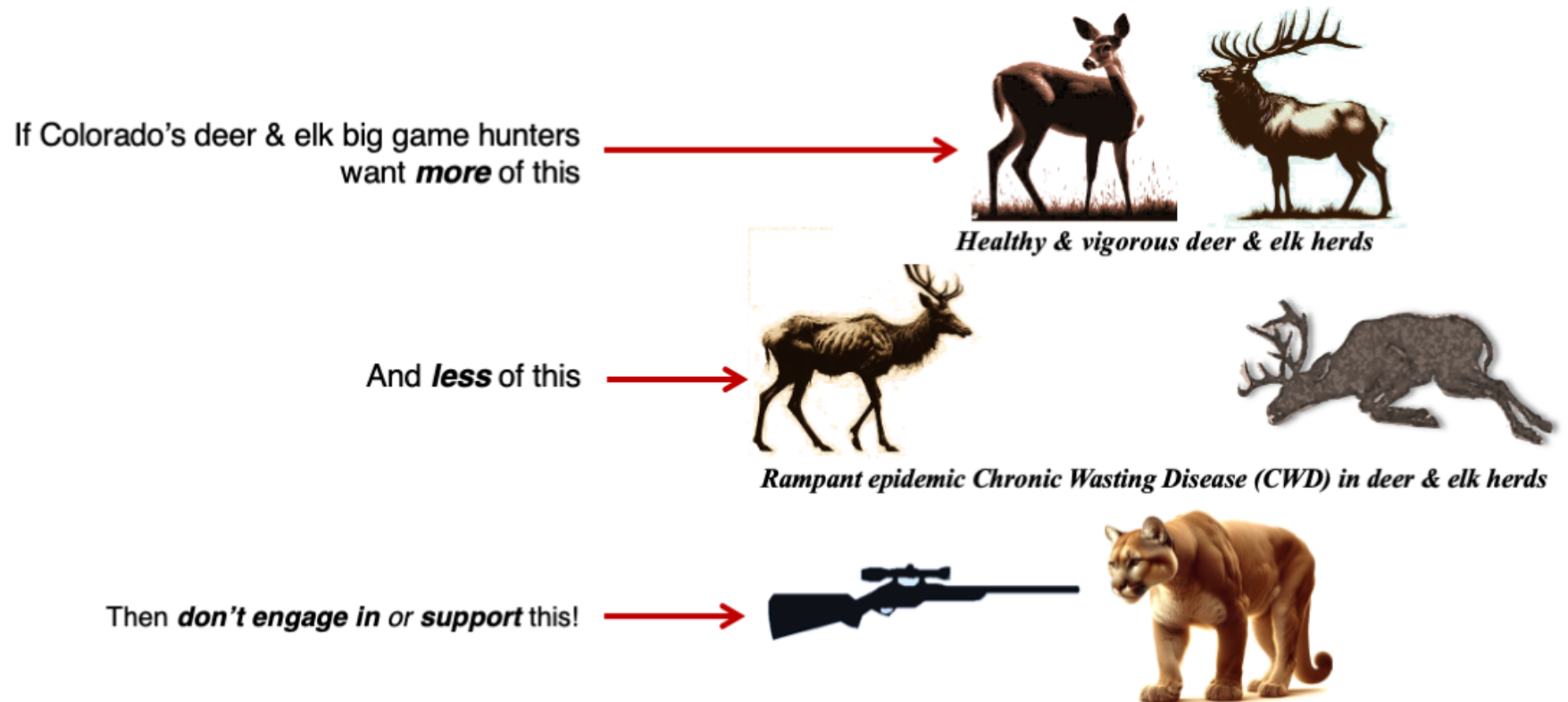
**Outcome – Less healthy** cervid populations

- *Early death of the fittest cervids*

Images generated by AI



## Figure 5: Mountain lions benefit Colorado deer & elk hunters



### Mountain lion trophy hunting in Colorado:

- WORSENS** CWD spread in deer & elk herds
- EXACERBATES** CWD zoonotic risk to people who consume deer & elk meat
- NOT** like principled deer & elk hunting
- NOT** fair chase – shoot a treed, exhausted & terrified lion unable to escape; a “fish in a barrel”
- NOT** ethical or honorable – basically a canned hunt; “guaranteed kill” w/ outfitter guides & hounds
- NOT** sporting or respectful of game – use e-distress calls & radio- & GPS-collared hounds to chase lions
- WASTEFUL** – false claims that lion meat is consumed
- NO** evidence of wildlife conservation value
- INCREASES** human-lion conflicts

### A simple solution to a complex problem:

**Leave mountain lions alone to manage CWD naturally via “predator cleansing”**

“CWD is the biggest threat to the future of deer hunting”

Theodore Roosevelt  
Conservation Partnership

Images generated by AI

## About the Author

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Jim Keen, D.V.M., Ph.D., earned his veterinary medicine and epidemiology doctorate degrees from the University of Illinois at Urbana-Champaign. He was a senior veterinary researcher focused on livestock and zoonotic infections with the USDA Agricultural Research Service in Nebraska for 15 years and later faculty at the University of Nebraska-Lincoln School of Veterinary Medicine for 13 years. His specific expertise is emerging and zoonotic infectious diseases of farmed animals.

He has broad field experience in outbreak investigation and animal disease control including enteric zoonotic bacteria from livestock in the U.S., Foot and Mouth Disease in the United Kingdom, and African Swine Fever in the Caucasus. Keen lives on his family's 140-year old grain farm in South Dakota. He is Director of Veterinary Sciences at the Center for a Humane Economy.