August 15, 2023

Michael Sloane, Department of Game and Fish Director
Tirzio Lopez, Vice Chair, New Mexico Game Commissioners
New Mexico Department of Game and Fish
1 Wildlife Way, Santa Fe, NM 87507
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Re: Comments on NMDGF's cougar (*Puma concolor*) four-year rulemaking process

Dear Director Sloane, Vice Chair Lopez, and Commissioners:

On behalf of the Humane Society of the United States, Animal Protection New Mexico, the Rio Grande Chapter of the Sierra Club, and our members and supporters in New Mexico, we thank you for this opportunity to comment on New Mexico Department of Game and Fish's four-year, proposed rule for cougars. As detailed below, New Mexico's quotas must be drastically reduced for cougars' conservation and future sustainability.

New Mexico law confirms that cougars must be conserved for all citizens. It is axiomatic that "agencies are created by statute, and limited to the power and authority expressly granted or necessarily implied by those statutes." *Qwest Corp. v. New Mexico Pub. Reg. Comm'n*, 140 N.M. 440, 446 (N.M. 2006). Thus "the Legislature, not the administrative agency, declares the policy and establishes…standards to which the agency must conform." *State ex rel. Taylor v. Johnson*, 125 N.M. 343, 349 (N.M. 1998). Here, the New Mexico Legislature created the Game Commission in order "to provide an adequate…system for the protection of the game and fish of New Mexico" and "to provide for their…protection, regulation, and conservation…" N.M.S.A. § 17-1-1. In promulgating rules and regulations pertaining to hunting, the Legislature expressly directed the Commission to give "due regard" to "the distribution, abundance…and breeding habits" of particular species. N.M.S.A. § 17-1-26. And, like all New Mexico agencies, the Game Commission may not establish rules that are "not supported by substantial evidence" or that are enacted "arbitrary or capriciously." N.M.S.A. § 39-3-1.1(D). Taken together, the statutory scheme authorizing this rulemaking requires evidence-driven, scientific management that seeks to sustainably maintain wildlife populations.

New Mexico's wildlife managers should develop a comprehensive management plan informed by the best available science. That management plan should clearly spell out goals and objectives so the public and decisionmakers alike are not kept in the dark. Instead, NMDGF developed a document totaling only 1.5 pages that encompasses both its proposed black bear (*Ursus americanus*) and cougar rule changes. NMDGF will accept comments on its proposed rules until some unknown date in September, at which time it will prepare final draft rules for both bears and cougars that will be posted to its website. It is uncertain if the public will have an opportunity to review and comment on these final draft rules before the Game Commission makes its decision in October. The public is left in the dark as to what studies NMDGF relies upon to make population determinations, and we have seen no population management objectives other than implicit hunter satisfaction and future hunting opportunities.

In other words, the process by which these rules were drafted, and the public was engaged, was a failed course of action.

Because so many uncertainties exist with NMDGF's proposed cougar rule, we provide these comprehensive comments, including all studies cited herein as part of the administrative record (which we will make available to you through a Google drive). We do this with the hope that the final rule will be informed by sound science and developed with clear objectives and goals, including the science about cougars and their prey, the paucity of livestock conflicts, and ensuring that cougar populations in New Mexico are genetically fit for long-term adaption in the face of so many threats to their persistence including loss of habitats and travel corridors, extreme droughts and severe, wholly unprecedented wildfires. Therefore, we ask that the Game Commission not adopt the proposed cougar rule as it is now written.

Instead, NMDGF must create a comprehensive rule supported by scientific justification for management of cougars and begin to work on a credible, long-term cougar management plan that outlines goals and objectives, including conserving New Mexico's cougars for future generations. Additionally, we ask that NMDGF, in the future, disseminate final draft rules instead of giving the public a shifting ground upon which to comment. Doing so will facilitate more informed decision-making.

NMDGF must include all sources of mortalities including hunter kill ("harvest"), predator control (ostensibly to bolster wild prey or protect domesticate livestock), other conflict kills, poaching, disease, known natural mortalities and roadkill as part of their quotas to prevent overkill of New Mexico's rare cougars.

While hunting cougars will neither bolster ungulate herds nor make people safer; however, persecuting cougars creates social chaos in their families resulting in even greater indirect mortalities from intraspecific aggression and, studies show, will exacerbate conflicts between cougars and people, pets and livestock.[1]

1. Recent scientific research results overwhelmingly demonstrate that NMDGF's cougar habitat model and associated density extrapolations have severely overestimated cougar population sizes and caused substantial overharvest; therefore, cougars should be managed much more conservatively in all Zones for which empirical density estimates do not exist

Murphy et al. (2019) produced the first contemporary, spatially explicit density estimate for cougars in New Mexico. That study estimated a mean density of 0.84 cougar/100 km^2 for the entirety of the former Cougar Zone F during 2017. At the time, NMDGF's cougar habitat model and associated density extrapolations authored by T.W. Perry (2010) predicted a mean density of 2.74 cougars/100 km^2 across all suitable habitat classes in Zone F,[2] which represented a 69% overestimation of cougar density compared to Murphy et al.'s (2019) empirical density estimate for Zone F. The associated hunt limit at that time was 46 total cougars and corresponded to NMDGF prescribing management that actually represented an 82% harvest rate instead of the intended 25% harvest rate (i.e., severe overharvest). This was the first scientific evidence that NMDGF's cougar habitat model and associated density extrapolations were severely flawed, unreliable, and had caused substantial overharvest of cougars. In response to the Murphy et al. (2019) study, NMDGF implemented an emergency reduction of cougar hunt limits in Zone F during 2019.

In NMDGF's 2023 cougar report, the agency contracted independent statisticians to further investigate the validity and reliability of cougar density estimates produced from the methods developed by Murphy et al. (2019) in New Mexico.[3] Using simulation and empirical data, those independent statisticians concluded that, under a wide range of sampling scenarios, Murphy et al.'s (2019) methods produced "results that aligned well with the models from our observed dataset in generating estimates with similar accuracy and precision," and did so with "relatively little bias to abundance [and density] estimates." However, such intense scrutiny has never been applied to NMDGF's unpublished, never-peer-reviewed, cougar habitat model, whereas the cougar density estimation methods developed by Murphy et al. (2019) not only passed those authors' own simulation and validation work, but also the scientific peer-review process and a separate independent review and critique by agency-contracted statisticians.

During 2018, NMDGF reapplied the methods developed by Murphy et al. (2019) to cougars in Zone F and also expanded the study area to include Zone B. The resulting density estimate of 0.70 cougar/100 km^2 not only

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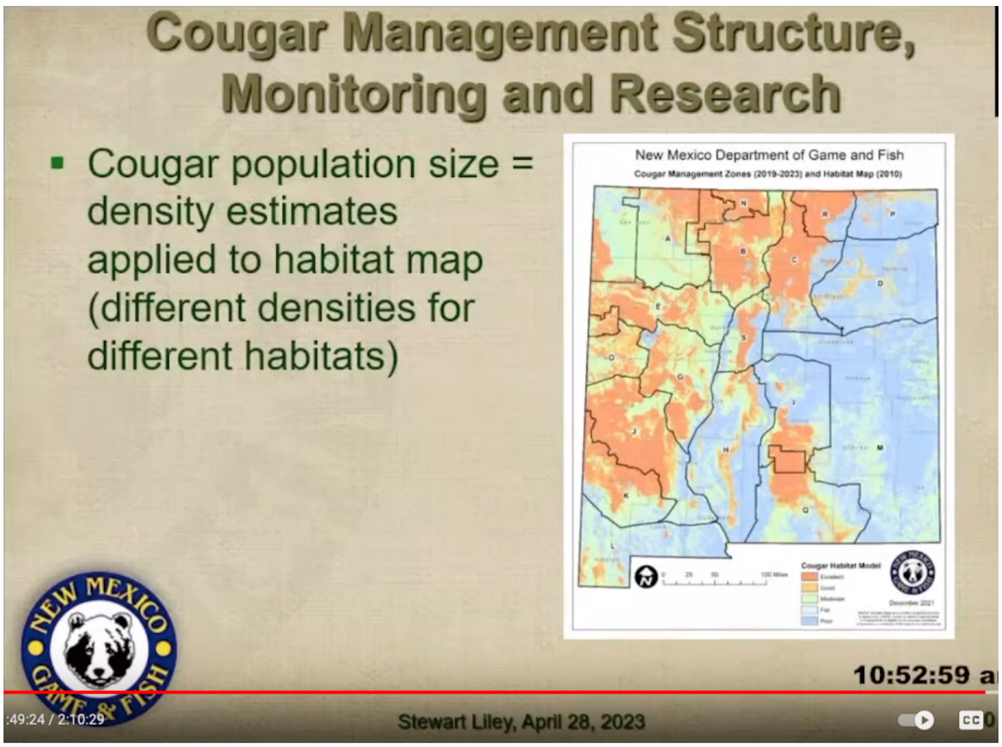
[1] L. Mark Elbroch and Adrian Treves, "Perspective: Why might removing carnivores maintain or increase risks for domestic animals?," *Biological Conservation* 283 (2023); D. J. Mattson, K.A. Logan, and L.L. Sweanor, "Factors governing risk of cougar attacks on humans," *Human-Wildlife Interactions* 5, no. 1 (2011).
[2] T.W. Perry, Mountain lion habitat model and population estimates for New Mexico. Report to New Mexico Department of Game and Fish, (Santa Fe, NM 2010).
[3] New Mexico Department of Game and Fish, Research summary 2018-2021: Estimating cougar density and population size in New Mexico using spatial mark-resight models, (2023).

corroborated the previous estimate produced by Murphy et al. (2019), but also demonstrated once again that NMDGF's cougar habitat model and density extrapolation approach had overestimated the cougar population in Zone B by 73%; the predicted mean density across habitat classes based on the cougar habitat model was 2.56 cougars/100 km^2 compared to the empirical spatially explicit estimate of 0.70 cougar/100 km^2.

At the time, the severe overestimation by NMDGF's cougar habitat model led the agency to implement a hunting limit of 28 cougars in Zone B, which, based on the empirical density estimate of 0.70 cougar/100 km^2, corresponded to an actual harvest rate of 61% instead of the intended 17% harvest rate. This was the second scientific evidence that NMDGF's cougar habitat model and associated density extrapolations were severely flawed, unreliable, and had caused substantial overharvest of cougars. In response to this considerable discrepancy between NMDGF's cougar habitat model and the empirical density estimate, NMDGF combined Zones F and B into a single Zone (the current Zone B) and substantially reduced harvest limits in those Zones for the 2020 Rule cycle.

Fig. 1. Bear and Cougar Rule slide from April 28, 2023, Game Commission hearing. New Mexico's cougar habitats



Finally, during 2019-2021, NMDGF applied the methods developed by Murphy et al. (2019) to cougars in Zone Q. The resulting empirical spatially explicit density estimate from that study of 0.56 cougar/100 km^2 was 67% lower than the predicted mean density of 1.72 cougars/100 km^2 across habitat classes that cougars had been managed at based on NMDGF's cougar habitat model. The hunt limit at the time of that study was 34 cougars, which, based on the empirical density estimate of 0.56 cougar/100 km^2, corresponded to an actual harvest rate of 52% and was once again much greater than NMDGF's intended 17% harvest rate. Those results further demonstrated that NMDGF's cougar habitat model and density extrapolation approach had severely overestimated the cougar population and caused substantial overharvest. In response to the recently produced empirical density estimate for cougars in Zone Q, NMDGF is proposing a corresponding reduction in the Zone Q hunt limit from 34 to 17 cougars for the 2024 Rule cycle to achieve a ~15% harvest rate.

In summary, three separate studies (Murphy et al. 2019, NMDGF 2023 (which discusses two studies)) conducted by NMDGF staff in three separate Cougar Management Zones (Zone B, Zone Q, and the former Zone F) that all used the same scientific methods that produce accurate and precise results, all of which were conducted within the last 6 years, have overwhelmingly demonstrated that NMDGF's cougar habitat model and associated density extrapolations approach (Perry 2010) is severely inaccurate, grossly unreliable, and has consistently overestimated local cougar population sizes and densities by 67-73%. Those empirical density studies further demonstrated that NMDGF's use of their cougar habitat model and density extrapolation approach has consistently caused severe mismanagement of cougars in all three Zones, resulting in hunt limits being prescribed that actually corresponded to realized harvest rates of 52-82% instead of the 17-25% that NMDGF intended. Despite the overwhelming empirical evidence that NMDGF's cougar habitat model and density extrapolation approach is unreliable and has caused substantial overharvest of local cougar populations in multiple Zones, the agency continues to rely on that unvalidated, never externally or independently peer-reviewed habitat model to derive cougar population sizes and prescribe hunting limits for the 16 other Zones in which empirical density estimates have not been produced. Proceeding forward with such a flawed approach would be an abhorrent disregard of NMDGF's own science and demonstrate that NMDGF is knowingly not meeting their own defined management objectives and causing severe overharvest of cougar populations in those 16 Zones (A, C, D, E, G, H, I, J, K, L, M, N, O, P, R, S).

It is critical that NMDGF recognize and accept that their cougar habitat model and density extrapolation approach is unreliable, and heed the results of their own empirical density studies by reducing the cougar hunt limits by 70% in all remaining 16 Zones for which empirical density estimates do not yet exist. All three empirical density studies demonstrated that NMDF's cougar habitat model and density extrapolation approach has consistently overestimated cougar populations by 67-73%, with a mean of 70%. Therefore, the cumulative, contemporary scientific evidence indicates that similar overestimation has occurred in the 16 other Zones that empirical cougar density estimates have not been obtained for.

2. Shifting from a scientifically and statistically valid method that NMDGF acknowledges produces accurate density estimates, to an unknown and unspecified "integrated population model" for estimating cougar population sizes, is nonsensical

Despite having a scientifically and statistically validated method, confirmed by other biologists, statisticians, and NMDGF staff, which produces accurate and precise density estimates for cougars (i.e, the Murphy et al. (2019) methods), which NMDGF has already applied to multiple cougar management zones, NMDGF Chief Stewart Liley stated during the April 2023 Game Commission hearing that New Mexico intends to adopt "integrated population models" (IPMs), for estimating cougar population sizes in New Mexico. Mr. Liley claimed these methods were similar to what Montana Fish, Wildlife & Parks (MFWP) has been using for cougars. Mr. Liley's statement is further corroborated by the *Bear and Cougar Rule – Proposed Changes Summary* that was compiled by NMDGF, in which the agency stated, "…we have also recently begun building integrated population models that incorporate all available data sources (survival from collared animals, age and sex data from harvested animals, hunter effort, etc.)." *However, Mr. Liley also stated during the April 2023 Game Commission hearing that this IPM methodology tends to inflate population estimates.* Furthermore, the data sources specified by NMDGF in the *Bear and Cougar Rule – Proposed Changes Summary* that would be used in IPMs (i.e., survival from collared animals, age and sex data from harvested animals, hunter effort, etc.) are not the foundational data required for an IPM,[4] nor are those the data sources being used in Montana's cougar IPM.[5] Instead, all those specified data sources are used in statistical population reconstruction (SPR) models to reconstruct (i.e., hindcast) population trends *during previous years*.[6] Indeed, in MFWP's description of their modeling approach for cougars in Montana (MFWP 2019), they state that an IPM is fit to demographic data to obtain vital rate estimates, and the resulting IPM parameter estimates are then subsequently used in a *separate* population reconstruction model with age-at-harvest data to evaluate what effects *previous management actions may have had on cougar populations in the past*. Thus, we assume that Mr. Liley and NMDGF staff are unaware of what IPMs actually are or the differences between IPMs and SPR models, and that NMDGF instead intends to implement SPR models.

This is worrisome, because multiple studies have demonstrated that for multiple felid species, including cougars, SPR models, which rely on hunter kill ("harvest") data, consistently produce abundance estimates that have too poor precision to be confidently used to implement future management actions and that SPR models often severely overestimate population sizes of felid species. For example, Arizona Game and Fish Department applied SPR models

[4] Michael Schaub and Fitsum Abadi, "Integrated population models: a novel analysis framework for deeper insights into population dynamics," *Journal of Ornithology* 152, no. 1 (2011); M. Schaub and M. Kery, *Integrated Population Models: Theory and Ecological Applications with R and JAGS* (London, U.K.: Academic Press, 2022).
[5] Montana Fish Wildlife and Parks, "Montana mountain lion monitoring and management strategy," (2019).
[6] John R Skalski, Kristin E Ryding, and Joshua Millspaugh, *Wildlife demography: Analysis of sex, age, and count data* (Burlington, MA: Elsevier, 2005).

to 15 years of harvest, hunter effort, and radio-collar survival data (i.e., the types of data that NMDGF stated would be used) and obtained cougar abundance estimates that had such poor precision (coefficient of variation [CV] = 0.43) that the agency could only conclude that somewhere between 459 and 5,023 cougars comprised the population.[7] Additionally, Murphy et al. (2022) found that Wyoming Game and Fish Department's SPR models severely overestimated bobcat population sizes and trends in Wyoming by an average of 9,191 bobcats per year.[8]

In their recent review of cougar density estimation studies, Murphy et al. (2022) concluded:

> …the lack of rigorous, model-based density estimates for many jurisdictions where pumas are legally hunted … indicates considerable uncertainty exists about the sustainability, effectiveness, and potential consequences of puma management...[9]

To abandon the approach developed by Murphy et al. (2019) that is now well-known to produce precise, accurate, and reliable cougar density and abundance estimates, which has already been successfully applied in three cougar management zones in New Mexico, for the harvest-based SPR modeling approach that is known to produce imprecise overestimates of abundance for cougars and other felids, is resoundingly nonsensical. Instead, NMDGF should continue to implement the validated and reliable approach of Murphy et al. (2019) in the remaining 16 cougar management zones to obtain empirical density and abundance estimates for cougars.

3. The objectives for NMDGF's management of cougars remains unknown because NMDGF still has not produced a cougar management plan

In their study of 667 North American wildlife management plans, Artelle et al. (2018) found that some or most of the four fundamental "hallmarks of science" (measurable objectives, evidence, transparency and independent review) were absent from most state or provincial wildlife management plans in the U.S. and Canada.[10] Sixty percent of the management plans reviewed contained fewer than half of those hallmarks necessary to meet standard scientific criteria.[11] Artelle and others found that governmental wildlife agencies failed to state their objectives for management, have quantitative information about wildlife population sizes, provide transparency about how hunting rates were estimated, or use independent peer review of their plans.[12] They write: "Our findings suggest that the assumed scientific basis of wildlife management across much of the United States and Canada might warrant reconsideration."[13] Artelle and others couldn't measure New Mexico's efforts, because it has produced no cougar or black bear management plans, which is outside the mainstream for wildlife management agencies.

Large-bodied carnivores such as cougars are sparsely populated across vast areas, invest in few offspring, provide extended parental care to their young and reproduce slowly.[14] Cougars are capable of self-regulation[15] and are also regulated by habitat and climatic conditions; that is, cougars occur at low densities relative to their primary prey making them sensitive to both bottom-up (prey declines) and top-down (human persecution such as from predator control or trophy hunting) influences.[16]

Furthermore, the genetic characteristics of New Mexico's cougars are virtually unknown. No information is available about the contemporary population genetic characteristics of cougars in New Mexico; nor is it known if some

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[7] April L. Howard et al., "Estimating Mountain Lion Abundance in Arizona Using Statistical Population Reconstruction," *The Journal of Wildlife Management* 84, no. 1 (2020).
[8] Sean M. Murphy et al., "Is unreliable science guiding bobcat management in Wyoming and other western U.S. states?," *Ecological Solutions and Evidence* 3, no. 1 (2022).
[9] Sean M. Murphy et al., "Review of puma density estimates reveals sources of bias and variation, and the need for standardization," *Global Ecology and Conservation* 35 (2022): , p. 14.
[10] Kyle A. Artelle et al., "Hallmarks of science missing from North American wildlife management," *Science Advances* 4, no. 3 (2018).
[11] Ibid.
[12] Ibid.
[13] Artelle et al., "Hallmarks of science missing from North American wildlife management," p. 3.
[14] A. D. Wallach et al., "What is an apex predator?," *Oikos* 124, no. 11 (2015).
[15] Wallach et al., "What is an apex predator?."; Tom Beck et al., *Cougar Management Guidelines* (Bainbridge Island, WA: WildFutures, 2005).
[16] D. Stoner, M. , M.L. Wolfe, and D. Choate, "Cougar Exploitation Levels in Utah: Implications for Demographic Structure, Population Recovery, and Metapopulation Dynamics," *Journal of Wildlife Management* 70 (2006); Beck et al., *Cougar Management Guidelines*.

populations are isolated and have small genetic effective sizes or low genetic diversity, or if migration rates are sufficient among populations to prevent deleterious genetic effects.[17]

In sum, researchers find that few wildlife agencies have scientifically credible wildlife management plans, and in the case of New Mexico cougars, no plan exists at all. Thus, we respectfully request that NMDGF develop a sound cougar management plan. Cougars have low fecundity and kitten survival is low. Kittens experience sexually selective infanticide because of aggressive trophy hunting and predator control, which further reduces populations and disrupts stable social organization among cougars. Unless cougar populations are continuously monitored, wildlife managers assume their populations are stable, when in fact they could be in decline. Cougars must be managed conservatively if they are to persist for future generations. The NMDGF must engage in multi-year population monitoring projects and ensure they have access to other populations to ensure their populations are large enough for long-term adaption. New Mexico should develop a cougar management plan in which travel corridors are mapped between populations to avoid inbreeding.

4. Cougars are not resilient to human pressures

Cougars reproduce slowly. A female cougar does not reach reproductive age until she is around two-and-a-half years old (between 27 and 29 months old) , and in her lifetime will produce only a few kittens who may survive to produce their own offspring. A mother gives birth to approximately three kittens every two years.[18] Females spend up to two years raising and providing for their kittens before they must disperse and find their own home range and mates. Only a few will survive this perilous journey. Females are the most important demographic of a cougar population; they ensure the continuation of the species.[19]

Female cougars are frequent victims of trophy hunting or predator control, both directly from the trophy hunter or predator control agent, and indirectly if the territorial male is killed leading to social chaos and intraspecific strife. Thus, a trophy hunter or predator control agent kills more than just the animal in the crosshairs: humans can create sudden disruption in cougars' social structures that leads to additional mortalities that are never counted in states' hunting quotas.[20]

[17] See: e.g., Craig L. Shafer, "A greater yellowstone ecosystem grizzly bear case study: genetic reassessment for managers," *Conservation Genetics Resources* (2022).
[18] Beck et al., *Cougar Management Guidelines*; R. B. Wielgus et al., "Effects of male trophy hunting on female carnivore population growth and persistence," *Biological Conservation* 167 (2013); C. M. S. Lambert et al., "Cougar Population Dynamics and Viability in the Pacific Northwest," *Journal of Wildlife Management* 70 (2006); K. A. Peebles et al., "Effects of remedial sport hunting on cougar complaints and livestock depredations," *PLoS ONE* 8 (2013).
[19] Kenneth A. Logan and Linda L. Sweanor, *Desert puma: evolutionary ecology and conservation of an enduring carnivore* (Washington, DC: Island Press, 2001). D. Barnhurst and F. G. Lindzey, "Detecting female mountain lions with kittens," *Northwest Science* 63, no. 1 (1989); T. Ruth, K. Murphy, and P. Buiotte, "Presence and Movements of Lactating and Maternal Female Cougars: Implications for State Hunting Regulations" (paper presented at the Seventh Mountain Lion Workshop, Jackson, Wyoming, 2003); T. P. Hemker, F. G. Lindzey, and B. B. Ackerman, "Population Characteristics and Movement Patterns of Cougars in Southern Utah," *Journal of Wildlife Management* 48, no. 4 (1984); Beck et al., *Cougar Management Guidelines*.
[20] Lambert et al., "Cougar Population Dynamics and Viability in the Pacific Northwest."; H. S. Cooley et al., "Source populations in carnivore management: cougar demography and emigration in a lightly hunted population," *Animal Conservation* 12, no. 4 (2009); H. S. Cooley et al., "Does hunting regulate cougar populations? A test of the compensatory mortality hypothesis," *Ecology* 90, no. 10 (2009); H. S. Robinson and R. Desimone, "The Garnet Range Mountain Lion Study: Characteristics of a Hunted Population in West-Central Montana: Final Report," *Montana Fish, Wildlife & Parks* (2011); H. S. Robinson et al., "A test of the compensatory mortality hypothesis in mountain lions: A management experiment in West-Central Montana," *Journal of Wildlife Management* 78, no. 5 (2014); H. S. Robinson et al., "Sink populations in carnivore management: Cougar demography and immigration in a hunted population," *Ecological Applications* 18, no. 4 (2008); Wielgus et al., "Effects of male trophy hunting on female carnivore population growth and persistence."; R. A. Beausoleil et al., "Research to Regulation: Cougar Social Behavior as a Guide for Management," *Wildlife Society Bulletin* 37, no. 3 (2013); Kaylie A. Peebles et al., "Effects of Remedial Sport Hunting on Cougar Complaints and Livestock Depredations," *Plos One* 8, no. 11 (Nov 19 2013), e79713, https://doi.org/10.1371/journal.pone.0079713, <Go to ISI>://WOS:000327311900042.

- Kittens are completely reliant upon their mother.[21] Kittens up to 17.5 months of age are likely incapable of dispatching prey animals on their own.[22] If a hunter or agent kills a mother, some or all the young kittens can die from starvation, dehydration, exposure or predation.[23]
- When hunters remove the stable adult cougars from a population, young male cougars are attracted to these vacancies; the immigrating young males may kill the kittens from the previous male so they can sire their own young (this is called sexually selected infanticide). In the process, however, females defending their kittens are also frequently killed.[24]

Cougars are not resilient in the face of heavy-handed hunting and trapping regimes.[25] At highest risk are females, who are the *biological bank account* of the species, and their kittens.[26]

5. Hunting and randomly controlling cougars neither decreases conflicts nor makes people safer

State wildlife management agencies wrongly suggest that cougar trophy hunting is necessary to make people safer.[27] Data show the risk of a cougar attack is miniscule; fewer than 30 people have died from a cougar attack in North America since 1890.[28] Cougars typically avoid people, so claims that trophy hunting will prevent future attacks are unsupported.[29] In fact, several cougar biologists assert that "no scientific evidence" exists to support the notion that trophy hunting reduces the risk of cougar attacks on humans.[30] When trophy hunters remove stable adult male cougars from a population, the disruption causes social chaos in their societies, and the loss of a stable adult male in his home range encourages multiple subadult males, who are less skilled at hunting, to immigrate.[31] Studies show that this influx of subadults likely causes human and livestock conflicts.[32] In North America, cougar predation on

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[21] "Kittens are generally able to climb to avoid dogs at about 3 months of age, but kittens orphaned when they are 6 months old have a less than 5% chance of survival, and most die from starvation" Cougar Management Guidelines Working Group, *Cougar Management Guidelines* (Bainbridge Island, WA: WildFutures, 2005)., p. 78.

[22] L. M. Elbroch and H. Quigley, "Observations of Wild Cougar (Puma concolor) Kittens with Live Prey: Implications for Learning and Survival," *Canadian Field-Naturalist* 126, no. 4 (2012); L. M. Elbroch, J. Feltner, and H. B. Quigley, "Stage-dependent puma predation on dangerous prey," *Journal of Zoology* 302, no. 3 (2017).

[23] Stoner, Wolfe, and Choate, "Cougar Exploitation Levels in Utah: Implications for Demographic Structure, Population Recovery, and Metapopulation Dynamics." Logan and Sweanor, *Desert puma: evolutionary ecology and conservation of an enduring carnivore*; Elbroch and Quigley, "Observations of Wild Cougar (Puma concolor) Kittens with Live Prey: Implications for Learning and Survival."; Elbroch, Feltner, and Quigley, "Stage-dependent puma predation on dangerous prey."

[24] Wielgus et al., "Effects of male trophy hunting on female carnivore population growth and persistence."; J. R. Keehner, R. B. Wielgus, and A. M. Keehner, "Effects of male targeted harvest regimes on prey switching by female mountain lions: Implications for apparent competition on declining secondary prey," *Biological Conservation* 192 (Dec 2015).

[25] J. L. Weaver, P. C. Paquet, and L. F. Ruggiero, "Resilience and conservation of large carnivores in the Rocky Mountains," *Conservation Biology* 10, no. 4 (1996); Wielgus et al., "Effects of male trophy hunting on female carnivore population growth and persistence."

[26] Logan and Sweanor, *Desert puma: evolutionary ecology and conservation of an enduring carnivore*; Beck et al., *Cougar Management Guidelines*.

[27] For example, Jerry Apker of Colorado Parks and Wildlife, in this interview makes an exaggerated claim about cougars' threats to humans. https://www.cpr.org/news/story/hunters-and-conservationists-odds-over-charismatic-cat. In Colorado, there has been one or two documented fatalities from cougars since white settlement.

[28] Mattson, Logan, and Sweanor, "Factors governing risk of cougar attacks on humans."; Lambert et al., "Cougar Population Dynamics and Viability in the Pacific Northwest."

[29] Beck et al., *Cougar Management Guidelines*; L. Sweanor et al., "Puma and Human Spatial and Temporal Use of a Popular California State Park," 72, no. 5 (2008); Mattson, Logan, and Sweanor, "Factors governing risk of cougar attacks on humans."; Peebles et al., "Effects of remedial sport hunting on cougar complaints and livestock depredations."

[30] Beck et al., *Cougar Management Guidelines*.

[31] Lambert et al., "Cougar Population Dynamics and Viability in the Pacific Northwest."; Robinson et al., "Sink populations in carnivore management: Cougar demography and immigration in a hunted population."; Cooley et al., "Does hunting regulate cougar populations? A test of the compensatory mortality hypothesis."; Cooley et al., "Source populations in carnivore management: cougar demography and emigration in a lightly hunted population."; Wielgus et al., "Effects of male trophy hunting on female carnivore population growth and persistence."; Peebles et al., "Effects of remedial sport hunting on cougar complaints and livestock depredations."; Beausoleil et al., "Research to Regulation: Cougar Social Behavior as a Guide for Management."; B. T. Maletzke et al., "Effects of hunting on cougar spatial organization," *Ecol Evol.* 4 (2014); Keehner, Wielgus, and Keehner, "Effects of male targeted harvest regimes on prey switching by female mountain lions: Implications for apparent competition on declining secondary prey."

[32] Beausoleil et al., "Research to Regulation: Cougar Social Behavior as a Guide for Management."; Peebles et al., "Effects of Remedial Sport Hunting on Cougar Complaints and Livestock Depredations." Kristine J. Teichman, Bogdan Cristescu, and Chris T. Darimont, "Hunting as a management tool? Cougar-human conflict is positively related to trophy hunting," *BMC Ecology* 16, no. 1 (2016).

domestic livestock is unremarkable (0.02% to 0.03% of the U.S. cattle inventory,[33]) but livestock conflicts are exacerbated by trophy hunting, studies show.[34]

6. Predator control of cougars will not grow prey populations and NMDGF's continuance of killing random cougars to bolster big horn sheep has *no* scientific merit

A. The scientific case for not using predator control to "grow" mule deer

Mule deer populations in the western United States have experienced population declines over the latter part of the last century, because of factors including habitat loss and fragmentation, highway barriers, disturbance from recreationists, changes in forage quality, competition with other ungulates, disease, hunting, poaching, stochastic weather events, fire suppression, noxious weeds, overgrazing by livestock, energy development, and fluctuations in hydrology caused by climate change—including reduced snow pack and increased temperatures.[35]

However, *eight decades* of scientific study demonstrate that killing native carnivores to increase ungulate populations is unlikely to produce positive results.[36]

The key to mule deer survival is access to adequate nutrition and protecting breeding females, not killing mule deer predators.[37] In recent studies that involved predator removal, those removals had no beneficial effect for mule deer.[38] If predators had been absent, the deer would have died from some other cause of mortality.[39]

In their long-term Colorado-based study, Bishop et al. (2009) determined that if deer had access to adequate nutrition, neither cougars nor coyotes negatively affected the deer population.[40] They also suggest that cougars selected for deer that had poor body condition.[41] Managing winter range for deer and reducing weeds and reseeding can greatly benefit

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[33] Kerry Murphy and Toni Ruth, "Diet and Prey Selection of a Perfect Predator," in *Cougar: Ecology & Conservation*, ed. Maurice Hornocker and Sharon Negri (Chicago and London: University of Chicago Press, 2010); The Humane Society of the United States, "Government data confirm that cougars have a negligible effect on U.S. cattle and sheep industries," *https://www.humanesociety.org/sites/default/files/docs/Cougar-Livestock-6.Mar_.19-Final.pdf* (2019).

[34] Peebles et al., "Effects of Remedial Sport Hunting on Cougar Complaints and Livestock Depredations."; Teichman, Cristescu, and Darimont, "Hunting as a management tool? Cougar-human conflict is positively related to trophy hunting."

[35] See, e.g., K. L. Monteith et al., "Life-history characteristics of mule deer: Effects of nutrition in a variable environment," *Wildlife Monographs* 186, no. 1 (2014); T. D. Forrester and H. U. Wittmer, "A review of the population dynamics of mule deer and black-tailed deer Odocoileus hemionus in North America," *Mammal Review* 43, no. 4 (2013).

[36] Adolph Murie, Ecology of the Coyote in the Yellowstone, (U.S. Government Printing Office, 1940); Stanley Adair Cain et al., "Predator control: Report to the President's Council on Environmental Quality by the Advisory Committee on Predator Control," (1971); National Research Council, *Wolves, bears, and their prey in Alaska* (Washington, D.C.: National Academy Press, 1997); R.B. Gill et al., *Declining Mule Deer Populations in Colorado: Reasons and Responses: A Report to the Colorado Legislature*, Colorado Division of Wildlife (Denver, 1999); Bruce Watkins, James Olterman, and Thomas Pojar, "Mule Deer Survival Studies on the Uncompahgre Plateau, Colorado 1997-2001," *Colorado Division of Wildlife* (2002); T. M. Pojar and D. C. Bowden, "Neonatal mule deer fawn survival in west-central Colorado," *Journal of Wildlife Management* 68, no. 3 (2004); J. Bright and J. Hervert, "Adult and fawn mortality of Sonoran pronghorn," *Wildlife Society Bulletin* 33 (2005). A. Mosnier et al., "Extensive predator space use can limit the efficacy of a control program," *Journal of Wildlife Management* 72, no. 2 (2008). C. D. Mitchell et al., "Population density of Dall's sheep in Alaska: effects of predator harvest?," *Mammal Research* 60, no. 1 (2015); L. R. Prugh and S. M. Arthur, "Optimal predator management for mountain sheep conservation depends on the strength of mesopredator release," *Oikos* 124, no. 9 (2015); Adrian Treves, Miha Krofel, and Jeannine McManus, "Predator control should not be a shot in the dark," *Frontiers in Ecology and the Environment* 14, no. 7 (2016); B. J. Bergstrom, "Carnivore conservation: shifting the paradigm from control to coexistence," *Journal of Mammalogy* 98, no. 1 (2017); R. D. Boertje et al., "Demography of an Increasing Caribou Herd With Restricted Wolf Control," *Journal of Wildlife Management* 81, no. 3 (2017); Robert J. Lennox et al., "Evaluating the efficacy of predator removal in a conflict-prone world," *Biological Conservation* 224 (2018); T. J. Clark and Mark Hebblewhite, "Predator control may not increase ungulate populations in the future: A formal meta-analysis," *Journal of Applied Ecology* 58, no. 4 (2021); T. Trump et al., "Sustainable elk harvests in Alberta with increasing predator populations," *PLoS ONE* 17, no. 10 (2022).

[37] Monteith et al., "Life-history characteristics of mule deer: Effects of nutrition in a variable environment."; Forrester and Wittmer, "A review of the population dynamics of mule deer and black-tailed deer Odocoileus hemionus in North America."; B. M. Pierce et al., "Top-down versus bottom-up forcing: evidence from mountain lions and mule deer," *Journal of Mammalogy* 93, no. 4 (2012).

[38] Forrester and Wittmer, "A review of the population dynamics of mule deer and black-tailed deer Odocoileus hemionus in North America."

[39] Monteith et al., "Life-history characteristics of mule deer: Effects of nutrition in a variable environment."

[40] C. J. Bishop et al., "Effect of Enhanced Nutrition on Mule Deer Population Rate of Change," *Wildlife Monographs*, no. 172 (2009).

[41] Bishop et al., "Effect of Enhanced Nutrition on Mule Deer Population Rate of Change."

mule deer.[42] In Idaho, Hurley et al. (2011) also found no effect on mule deer populations even after large numbers of cougars and coyotes were killed – because they found that winter severity was a greater influence than carnivores on neonate survival.[43] Elbroch et al. (2017) found that overhunting large carnivores to prevent competition with human hunters was unfounded because of ecological complexities.[44]

In their review article that surveyed 48 predation studies involving mule deer, Forrester and Wittmer (2013) determined that, while predation was the "primary proximate cause of mortality for all age classes" of deer, predator removal studies indicate that "predation is compensatory, particularly at high deer densities, and that nutrition and weather shape population dynamics."[45] In other words, each year, some deer are "doomed surplus;" that is, some deer will die no matter what.[46] In their study, Monteith et al. (2014) found that both additive and compensatory mortality can occur in a single year.[47]

Cougar predation on mule deer in California was likely additive during one time period of an increasing deer population, but it did not stop the growth of the population, which indicates that resource availability, particularly food, is important to mule deer.[48] The condition of the deer was strongly correlated with the availability of nutrition, and thus cougar predation during a deer decline was not an additive source of mortality.[49] Young animals who have access to fewer nutritional reserves are less likely to survive.[50] Mule deer foods can be hindered by weather, habitat loss, oil and gas development, fire suppression, and competition with domestic livestock.[51]

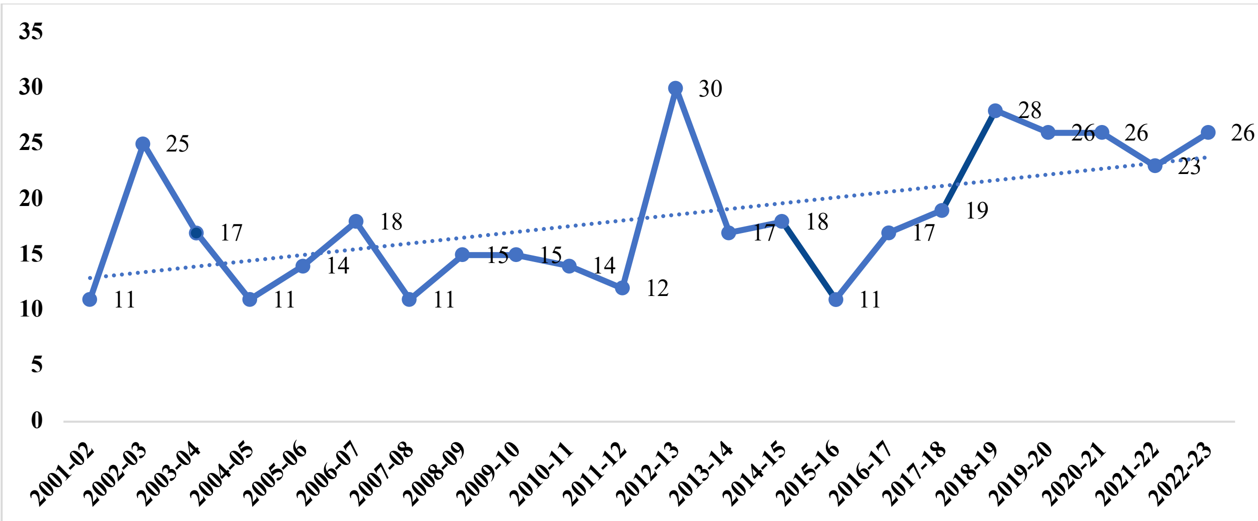
B. The scientific case for not using predator control to "grow" bighorn sheep

On June 27, 2023, when the Humane Society of the United States, Animal Protection New Mexico and the Rio Grande Chapter of Sierra Club met with NMDGF personnel. The state confirmed that cougar removals were conducted at random and not targeted at individuals who actually prey on bighorn sheep—undermining the credibility of this program. Fig. 2. The trend is increasing and involves an average of 18 cougars per year. It cannot be unscored enough: The ethics of New Mexico's program to kill cougars to enhance bighorn sheep has met with much condemnation in both the scientific community, including in a publication entitled "Lions versus lambs," and by the public.[52] But despite the scientific and majority public consensus against these killing projects, NMDGF continues with this controversial practice. It is clear from the literature that bighorn sheep populations are in decline in the U.S. because of unregulated market hunting, trophy hunting, disease from domestic sheep,[53] resource competition by livestock, and loss of habitat.[54] The Payette National Forest's Draft EIS (January 2010), provides an excellent literature review on bighorn sheep die offs, and attributes them to domestic livestock; the EIS recommends that wild

[42] E. J. Bergman et al., "Habitat Management Influences Overwinter Survival of Mule Deer Fawns in Colorado," *Journal of Wildlife Management* 78, no. 3 (2014).
[43] M. A. Hurley et al., "Demographic Response of Mule Deer to Experimental Reduction of Coyotes and Mountain Lions in Southeastern Idaho," *Wildlife Monographs*, no. 178 (2011).
[44] L. Mark Elbroch, Jennifer Feltner, and Howard Quigley, "Human–carnivore competition for antlered ungulates: do pumas select for bulls and bucks?," *Wildlife Research* 44, no. 7 (2017).
[45] Forrester and Wittmer, "A review of the population dynamics of mule deer and black-tailed deer Odocoileus hemionus in North America," p. 292.
[46] Monteith et al., "Life-history characteristics of mule deer: Effects of nutrition in a variable environment."
[47] Monteith et al., "Life-history characteristics of mule deer: Effects of nutrition in a variable environment."
[48] Pierce et al., "Top-down versus bottom-up forcing: evidence from mountain lions and mule deer."
[49] Pierce et al., "Top-down versus bottom-up forcing: evidence from mountain lions and mule deer."
[50] Monteith et al., "Life-history characteristics of mule deer: Effects of nutrition in a variable environment."; Pojar and Bowden, "Neonatal mule deer fawn survival in west-central Colorado."; Watkins, Olterman, and Pojar, "Mule Deer Survival Studies on the Uncompahgre Plateau, Colorado 1997-2001."; Bishop et al., "Effect of Enhanced Nutrition on Mule Deer Population Rate of Change."
[51] Forrester and Wittmer, "A review of the population dynamics of mule deer and black-tailed deer Odocoileus hemionus in North America."; Monteith et al., "Life-history characteristics of mule deer: Effects of nutrition in a variable environment."
[52] K. West, "Lion versus lamb - In New Mexico, a battle brews between two rare species," *Scientific American* 286, no. 5 (2002); B. A. Minteer and J. P. Collins, "Ecological ethics: Building a new tool kit for ecologists and biodiversity managers," *Conservation Biology* 19, no. 6 (2005).
[53] "Severe pneumonia outbreak kills bighorn sheep: Lamb survival to be closely monitored for several years" http://www.avma.org/onlnews/javma/may10/100501c.asp
[54] Murphy and Ruth, "Diet and Prey Selection of a Perfect Predator."; Logan and Sweanor, *Desert puma: evolutionary ecology and conservation of an enduring carnivore*; K. L. Monteith et al., "Effects of harvest, culture, and climate on trends in size of horn-like structures in trophy ungulates," *Wildlife Monographs* 183, no. 1 (2013); Becky Lomax, "Tracking the Bighorns," *Smithsonian* 38, no. 12 (2008), http://www.smithsonianmag.com/science-nature/tracking-the-bighorns-20258170/; Luis S. Warren, *The Hunter's Game: Poachers and Conservationists in Twentieth-Century America* (New Haven: Yale University Press, 1997).

and domestic sheep and goats be separated.[55] Scabies can also be fatal and has been documented in New Mexico bighorn sheep populations.[56]

Fig. 2. As part of an increasing trend, NMDGF randomly kills an average of 18 cougars per year to "grow" bighorn sheep populations—an endeavor with no scientific merit. Predator-control operations result in other uncounted cougar mortalities (because of sexually selected infanticide and intraspecific strife from the social disruption of family groups). Ironically, trophy hunting and predator control of cougars can exacerbate the losses of numerically rare prey such as bighorn sheep



It is clear from the literature that bighorn sheep populations are in decline in the U.S. because of unregulated market hunting, trophy hunting, **disease from domestic sheep**,[57] resource competition by livestock, and loss of habitat.[58]

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[55] http://www.fs.fed.us/r4/payette/publications/big_horn/index.shtml. It states: Bighorn sheep are a New World species and are closely related to domestic sheep, which are an Old-World species. Domestication and intense artificial selection have probably helped domestic sheep develop a resistance to important diseases (Jessup 1985). However, bighorn sheep can be highly susceptible to diseases carried by domestic sheep. A long history of large-scale, sudden, all-age die-offs in bighorn sheep exists across Canada and the United States, many associated with domestic animal contact (Shackleton 1999). Although limited knowledge of transmission dynamics exists (Garde et al. 2005), extensive scientific literature supports the relationship between disease in bighorn sheep populations and contact with domestic sheep, including both circumstantial evidence linking bighorn die- offs in the wild to contact with domestic animals and controlled experiments where healthy bighorn sheep exposed to domestic sheep displayed subsequently high mortality rates (Foreyt 1989, 1990, 1992; Foreyt et al. 1994; Onderka et al. 1988; Onderka and Wishart 1988; Garde et al. 2005). In a summary of risk to wild sheep from Pasteurella and Mannheimia spp., Garde et al. (2005) makes the following conclusions:
1. These bacteria can cause pneumonia in bighorn sheep, but there are benign commensal strains in the upper respiratory tract
2. Domestic sheep, goats, and llamas have been reported with these bacteria species
3. Wild sheep and mountain goats have been reported with these bacteria species
4. Transmission is by direct contact and aerosolization
5. These bacteria species do not persist in the environment
6. Acute-to-chronic die-offs in bighorn sheep can result in low to 100 percent mortality, although they can be present in healthy sheep
7. These bacteria are considered opportunistic and can result in pneumonia outbreaks
8. These bacteria can cause clinical disease in domestic sheep and goats, but are rarely primary pathogens.
Management Recommendations: The separation, either spatially, temporally, or both of bighorn sheep from domestic sheep has been recommended by leading bighorn sheep disease experts (Schommer and Woolever 2001, Garde 2005, Singer 2001). Experts also recommend developing site-specific solutions for each bighorn sheep population and domestic sheep allotment, and to develop a management strategy appropriate for the complexity of the management situation (Schommer and Woolever 2001).

[56] W. M. Boyce and M. E. Weisenberger, "The rise and fall of psoroptic scabies in bighorn sheep in the San Andres Mountains, New Mexico," *Journal of Wildlife Diseases* 41, no. 3 (2005).

[57] "Severe pneumonia outbreak kills bighorn sheep: Lamb survival to be closely monitored for several years" http://www.avma.org/onlnews/javma/may10/100501c.asp

[58] Murphy and Ruth, "Diet and Prey Selection of a Perfect Predator."; Logan and Sweanor, *Desert puma: evolutionary ecology and conservation of an enduring carnivore*; Monteith et al., "Effects of harvest, culture, and climate on trends in size of horn-like structures in

Sawyer and Lindzey (2002) surveyed more than 60 peer-reviewed articles concerning predator-prey relationships involving bighorn sheep and cougars, and concluded that while predator control is often politically expedient, it often does not address underlying environmental issues such as habitat loss, loss of migration corridors, and inadequate nutrition that cause big horn sheep declines.[59] At the time of their review, they had not contemplated the 20-year megadrought in New Mexico.[60]

Cougars cache their prey under vegetative cover to prevent detection by scavengers, to cool and to impede spoiling.[61] Cougars remain close to their kills and feed generally on the kill for two to five nights.[62] This behavior affords researchers the opportunity to avoid targeting a subpopulation and remove only individuals who feed on bighorn sheep.

The NMDGF can better plan for bighorn sheep management by selecting relocation sites for bighorn sheep that have little stalking cover.[63] Escape terrain that contains cliffs, rocks, and foliage makes excellent ambush cover for cougars and should be avoided.[64] In their first year, newly transplanted bighorn sheep travel long distances from the release site, which makes them vulnerable to predation.[65]

A host of authors reviewed by McKinney et al. (2006) and Ruth and Murphy (2010) recommend only limited cougar removals to benefit bighorn sheep populations.[66] Authors suggest:

- Predation is greatest where mule deer and bighorn sheep are sympatric and that predation on bighorn increases when mule deer herds decline.[67]
- Group size of released bighorns, habitat quality and quantity, alternative prey such as mule deer, escape terrain at relocation sites can affect translocation efforts.[68]
- Logan and Sweanor (2001) found the desert bighorn sheep population in their study area to be negatively affected by drought, disease, and lack of connectivity to other subpopulations and that predation was not additive.[69]

Predator control and trophy hunting cougars can result in the unintended consequences of increasing cougar immigration, particularly when a dominant male is removed (increasing the cougar density of an area) or causing female cougars to shift to a different range (occupied by bighorn sheep) to avoid incoming infanticidal males.[70] These

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trophy ungulates."; Lomax, "Tracking the Bighorns."; Warren, *The Hunter's Game: Poachers and Conservationists in Twentieth-Century America*.

[59] Hall Sawyer and Frederick Lindzey, "Review of Predation on Bighorn Sheep (Ovis canadensis)," *Prepared for Wyoming Animal Damage Management Board, Wyoming Domestic Sheep and Bighorn Sheep Interaction Working Group, Wyoming Game and Fish Department.* (2002).

[60] Alton Williams, Benjamin Cook, and Jason Smerdon, "Rapid intensification of the emerging southwestern North American megadrought in 2020–2021," *Nature Climate Change* 12 (2022).

[61] Murphy and Ruth, "Diet and Prey Selection of a Perfect Predator."

[62] Murphy and Ruth, "Diet and Prey Selection of a Perfect Predator."; Ted McKinney et al., "Mountain Lion Predation of Translocated Desert Bighorn Sheep in Arizona," *Wildlife Society Bulletin* 34, no. 5 (2006); Ted McKinney, Thorry W. Smith, and James C. deVOS, "Evaluation of Factors Potentially Influencing a Desert Bighorn Sheep Population," *Wildlife Monographs* 164 (2006).

[63] Murphy and Ruth, "Diet and Prey Selection of a Perfect Predator."; McKinney et al., "Mountain Lion Predation of Translocated Desert Bighorn Sheep in Arizona."; McKinney, Smith, and deVOS, "Evaluation of Factors Potentially Influencing a Desert Bighorn Sheep Population."

[64] McKinney et al., "Mountain Lion Predation of Translocated Desert Bighorn Sheep in Arizona."; McKinney, Smith, and deVOS, "Evaluation of Factors Potentially Influencing a Desert Bighorn Sheep Population."

[65] McKinney et al., "Mountain Lion Predation of Translocated Desert Bighorn Sheep in Arizona."; McKinney, Smith, and deVOS, "Evaluation of Factors Potentially Influencing a Desert Bighorn Sheep Population."

[66] McKinney, Smith, and deVOS, "Evaluation of Factors Potentially Influencing a Desert Bighorn Sheep Population."; McKinney et al., "Mountain Lion Predation of Translocated Desert Bighorn Sheep in Arizona."; Murphy and Ruth, "Diet and Prey Selection of a Perfect Predator."

[67] Toni Ruth and Kerry Murphy, "Cougar-Prey Relationships," in *Cougar: Ecology and Conservation*, ed. Maurice Hornocker and Sharon Negri (Chicago and London: University of Chicago Press, 2010); Lambert et al., "Cougar Population Dynamics and Viability in the Pacific Northwest."

[68] Ruth and Murphy, "Cougar-Prey Relationships."; McKinney et al., "Mountain Lion Predation of Translocated Desert Bighorn Sheep in Arizona."; McKinney, Smith, and deVOS, "Evaluation of Factors Potentially Influencing a Desert Bighorn Sheep Population."

[69] Logan and Sweanor, *Desert puma: evolutionary ecology and conservation of an enduring carnivore*.

[70] Keehner, Wielgus, and Keehner, "Effects of male targeted harvest regimes on prey switching by female mountain lions: Implications for apparent competition on declining secondary prey."

exacerbate the loss of numerically rare species such as bighorn sheep.[71] To emphasize, a host of authors recommend only targeted removals to benefit bighorn sheep populations because most cougars do not prey on bighorn sheep. The literature is clear: the problems sheep face are trophy hunters, livestock—because they are important disease vectors and because they compete with wild sheep for limited resources—habitat loss, and lack of adequate nutrition.

To conclude: Eight decades of study demonstrates that killing native carnivores to increase ungulate populations is unlikely to produce positive results (see citation above for references). Treves et al. (2019) and Clark and Hebblewhite (2021) also suggest that predator removals to grow prey herds is suspect, and they add to the body of scientists who call for unbiased randomized experiments with cross-over design and to determine if such experiments are worthy to be distinguished as meeting scientific standards.[72] Clark and Hebblewhite's (2021) meta-analysis found that predator control experiments actually caused a decline in ungulate numbers, growth rates, survival and recruitment.[73] While at the same time, Trump et al. (2022) found that despite increasing numbers of grizzly bears, cougars and wolves, elk hunters in Alberta killed more elk over time and their success rate increased.[74] Treves et al. (2022) in their review article found that killing wolves generally will not increase ungulate abundance, and the exception is when ungulate populations are small.[75] To underscore, ungulate population density is limited by their access to nutrition, or what biologists call ungulates' "nutritional carrying capacity."[76] In total, the best available science suggests that persecuting cougar populations is not a solution toward enhancing mule deer or bighorn sheep numbers. That is because cougar predation upon bighorn sheep is a learned behavior conducted by only a few individuals who may or may not repeat their behavior.[77] In sum, New Mexico must come into the 21st Century and stop persecuting rare, native cougars in misguided attempts to grow ungulate herds.

7. Cougars and their prey did not evolve to face the climate crisis—thus cougars must be managed carefully to prevent their extirpation

A hotter planet risks species extinction, changes plant phenology (indirectly affecting cougars' food resources), reduces insulating snow cover for den sites, increases parasite invasions and increases drought in the West (harming both plants and setting the stage for severe wildfires). This is a difficult time for New Mexico's cougars to attempt to survive.

In 2019, a Paris conference of the Science-Policy Platform on Biodiversity and Ecosystem Services issued a press release from 145 participants from 50 countries who had assessed changes on Planet Earth for the past five decades and found that *one million species face extinction*, the most in human history. They reported that the species extinction rate is accelerating and is the greatest ever over the last 10 million years. They also stated that regarding climate change, Planet Earth's temperature is increasing at "+/-0.2 (+/-0.1) degrees Celsius per decade" and that "for global warming of 1.5 to 2 degrees, the majority of terrestrial species ranges are projected to shrink profoundly."[78]

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[71] Ruth and Murphy, "Cougar-Prey Relationships."; C. M. Lambert et al., "Cougar population dynamics and viability in the Pacific Northwest," *J Wildl Manage.* 70 (2006), https://doi.org/10.2193/0022-541x(2006)70[246:cpdavi]2.0.co;2, http://dx.doi.org/10.2193/0022-541X(2006)70[246:CPDAVI]2.0.CO;2; Stoner, Wolfe, and Choate, "Cougar Exploitation Levels in Utah: Implications for Demographic Structure, Population Recovery, and Metapopulation Dynamics."; Robinson et al., "Sink populations in carnivore management: Cougar demography and immigration in a hunted population."; Cooley et al., "Source populations in carnivore management: cougar demography and emigration in a lightly hunted population."; Keehner, Wielgus, and Keehner, "Effects of male targeted harvest regimes on prey switching by female mountain lions: Implications for apparent competition on declining secondary prey."

[72] A. Treves et al., "Predator Control Needs a Standard of Unbiased Randomized Experiments With Cross-Over Design," *Frontiers in Ecology and Evolution* 7, no. 462 (2019). Clark and Hebblewhite, "Predator control may not increase ungulate populations in the future: A formal meta-analysis."

[73] Clark and Hebblewhite, "Predator control may not increase ungulate populations in the future: A formal meta-analysis."

[74] Trump et al., "Sustainable elk harvests in Alberta with increasing predator populations."

[75] A. Treves, L. M. Elbroch, and J. Bruskotter, "Pre-print. Evaluating fact claims accompanying policies to liberalize the killing of wolves," *Conservation Science and Practice* https://faculty.nelson.wisc.edu/treves/pubs/preprint_Treves_Elbroch_Bruskotter.pdf (2022).

[76] Monteith et al., "Life-history characteristics of mule deer: Effects of nutrition in a variable environment."

[77] Logan and Sweanor, *Desert puma: evolutionary ecology and conservation of an enduring carnivore*; McKinney et al., "Mountain Lion Predation of Translocated Desert Bighorn Sheep in Arizona."; McKinney, Smith, and deVOS, "Evaluation of Factors Potentially Influencing a Desert Bighorn Sheep Population."; Ruth and Murphy, "Cougar-Prey Relationships."

[78] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), "Nature's Dangerous Decline 'Unprecedented' Species Extinction Rates 'Accelerating': Current global response insufficient. 'Transformative changes' needed to restore and protect nature; Opposition from vested interests can be overcome for public good. Most comprehensive assessment of its kind; 1,000,000 species threatened with extinction," news release, 2019.

(IPBES issued an updated report in 2021.[79]) The consequence of this warming, according to two dozen academics on fire ecology, is a "hotter climate and a markedly different biosphere."[80]

The loss of Earth's megafauna has so concerned preeminent biologists that dozens of them convened, and in 2011, produced a seminal and alarming paper, *Trophic Downgrading of Planet Earth*.[81] In it, the biologists, Estes et al. (2011), warn that the loss of top carnivores and other megafauna will increase pandemics, make ecosystems dysfunctional and accelerate the harms from climate change.[82] Cougars are megafauna, and may be gravely threatened by climate change:

- Climate warming will change trophic effects that include the profusion of parasites and disease.[83]
- With warmer winters and extended fall and spring seasons, climate change will drive the expansion of ticks and tick-borne diseases to more northern latitudes and to higher altitudes.[84] Increases in temperature facilitate the proliferation of parasitic organisms.[85]
- Rising temperatures have resulted in changed plant phenology, which is the timing of flowering, germination and leaving.[86] For bears, this means that some of their natural foods such as acorns (hard mast crops) or raspberries (soft mast crops) will be unavailable in some years because of drought, fires, or late spring frosts.
- Declining species' diversity could exacerbate phenological changes associated with warming.[87] Climate change affects temperatures and moisture, affecting precipitation amounts and thus plant growth, which could further degrade cougar-preys' food supplies.[88]
- And in the Western United States, drought has intensified to extremes not seen in the past 20 years.[89] Drought begets wildfire, and more severe droughts alter historic fire regimes.[90] As discussed below, wildfires pose grave threats to cougars and their prey.

Faced with hotter, dryer habitats in New Mexico, the wildlife agency must reduce quotas on cougars because they face so many obstacles to their persistence.

8. New Mexico's cougars and their prey face unprecedented droughts and wildfires

Kelly et al. (2020) is a review article published in *Science*, and is authored by two dozen biologists who reviewed 29,000 journal articles on wildfires. They warn of extinction risk from fire regimes that are different from the ones that species have evolved with; that is, the "type, frequency, intensity, seasonality and spatial dimensions of recurrent fire."[91] For wildlife, the variations in intensity and occurrence of fire can reduce food and shelter, and reduce animals' ability to "recolonize regenerating habitats," and in the case of severe fires, lead to mortality.[92]

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[79] Intergovernmental Panel on Climate Change, Climate change 2021: The physical science basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, (https://www.ipcc.ch/report/ar6/wg1/#SPM: Cambridge University Press, 2021).
[80] L. T. Kelly et al., "Fire and biodiversity in the Anthropocene," *Science* 370, no. 6519 (2020): p. 2.
[81] A Estes, James & Terborgh, John & Brashares, Justin & E Power, Mary & Berger, Joel & Bond, William & R Carpenter, Stephen & Essington, Timothy & D Holt, Robert & Jackson, Jeremy & Marquis, Robert & Oksanen, Lauri & Oksanen, Tarja & Paine, Robert & Pikitch, Ellen & Ripple, William & Sandin, Stuart & Scheffer, Marten & W Schoener, Thomas & Wardle, David. (2011). Trophic Downgrading of Planet Earth. Science (New York, N.Y.). 333. 301-6. 10.1126/science.1205106.
[82] J. A. Estes et al., "Trophic Downgrading of Planet Earth," *Science* 333, no. 6040 (2011).
[83] K. S. McKelvey and P. C. Buotte, "Climate change and wildlife in the Northern Rockies Region," in *Climate change vulnerability and adaptation in the Northern Rocky Mountains*, ed. Jessica E. Halofsky et al. (Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain, 2018).
[84] Filipe Dantas-Torres, *Climate change, biodiversity, ticks and tick-borne diseases: The butterfly effect*, vol. 4 (2015).
[85] Erica E. Short, Cyril Caminade, and Bolaji N. Thomas, "Climate Change Contribution to the Emergence or Re-Emergence of Parasitic Diseases," *Infectious Diseases: Research and Treatment* 10 (2017).
[86] Amelia A. Wolf, Erika S. Zavaleta, and Paul C. Selmants, "Flowering phenology shifts in response to biodiversity loss," *Proceedings of the National Academy of Sciences* 114, no. 13 (2017).
[87] Wolf, Zavaleta, and Selmants, "Flowering phenology shifts in response to biodiversity loss."
[88] McKelvey and Buotte, "Climate change and wildlife in the Northern Rockies Region."
[89] Nadja Popovich, "How severe is the Western drought? See for yourself," *The New York Times* (https://www.nytimes.com/interactive/2021/06/11/climate/california-western-drought-map.html?searchResultPosition=2) 2021; Williams, Cook, and Smerdon, "Rapid intensification of the emerging southwestern North American megadrought in 2020–2021."
[90] Kelly et al., "Fire and biodiversity in the Anthropocene."
[91] Kelly et al., "Fire and biodiversity in the Anthropocene," p. 1.
[92] Kelly et al., "Fire and biodiversity in the Anthropocene."

Williams et al. (2022) found that the southwestern region of the United States experienced a "megadrought" in 2020-2021, the driest period since 800 A.D.[93] The United Nations released its 2022 report, "Spreading like wildfire: the rising threat of extraordinary landscape fire," authored by 50 researchers who found that the risk of wildfires worldwide could increase by 57% by the end of the century with some regions of the world in great danger.[94] Amidst these warnings, in 2022 New Mexico experienced two of the largest fires in recorded history, the Calf Canyon/Hermits Peak fire and the Black Fire—and those were not the only fires in the state that year.

Fire suppression, climate change and logging have changed the forests in the West over the past century.[95] This means that New Mexico cougars face fire regimes different than those with which they evolved. Invasive and pervasive cheat grass (*Bromus tectorum*) has increased fuel loads in the West.[96] Recent wildfires are hotter and kill mature trees because of fuel-load buildup.[97] Western fire-adapted forests generally had experienced frequent fires on a 10 to 20-year time scale, but those fires now burn at intervals between 70-90 years.[98] The result is that forests are now characterized by denser stands of trees with few trees older than 250 years and with diameters greater than 60 cm.[99] These smaller diameter trees grow in dense forests that are apt to experience stand-replacing fires.[100] Large fires leave a mosaic or burn patches of different levels of burn severity.[101] In fire ecology, the severity of the fire is highly variable. Lewis et al. (2022) write:

> Fire severity . . . occurs across a gradient, which is characterized by **unburned forest** (where fire has not occurred for an extended period of time), **low fire severity** (where fire burns in the understory and does not kill mature trees), **moderate fire severity** (where fire kills some mature trees, but others survive), and **high fire severity** (where fire kills most or all trees, or at least top-kills them where the above ground portion of the tree is killed, but the root system remains alive). Wildfires are often characterized as mixed-severity, where a heterogeneous pattern of multiple fire severity types occur, especially for wildfires occurring over relatively large areas (Baker, 2009; Perry et al., 2011; Odion et al., 2014). **As fire severity increases, forest canopy cover decreases,** but **some plants can subsequently exhibit prolific regeneration through resprouting, suckering, or seed germination**; for example, some grasses, forbs, shrubs, and trees can exhibit a pulse of growth post fire (Lentile et al., 2007; Baker, 2009). In particular, fire-adapted species, such as aspen (*Populus tremuloides*) and Gambel oak (*Quercus gambelii*), can demonstrate rapid and widespread regeneration and growth in areas of moderate to high fire severity (Brown and DeByle, 1989; Bartos et al., 1994; Bailey and Whitham, 2002; Mack et al., 2008; Wan et al., 2014; Clement et al., 2019). **Importantly, heterogeneity in plant quantity and quality across the gradient of fire severity is expected to influence animal populations and habitat use**.[102]

In their camera trap study of the effects of fires in California between 2009 and 2018 on black bears, cougars and a host of mesocarnivores such as skunks, foxes, ringtails and bobcats, Furnas et al. (2021) found the greatest carnivore richness in areas that experienced *intermediate* fire severity – that is, on landscapes where fires occurred on a 10-year

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[93] Williams, Cook, and Smerdon, "Rapid intensification of the emerging southwestern North American megadrought in 2020–2021."
[94] United Nations Environment Programme, "Spreading like wildlife — The rising threat of extraordinary landscape fires," *file:///Users/wkeefover/Downloads/United%20Nations%20Environment%20Programme%20(2022).%20Spreading%20like%20Wildfire%20%E2%80%93%20Rising%20Threat%20of%20Extraordinary%20Landscape%20Fires.pdf* (2022).
[95] Brett J. Furnas, Benjamin R. Goldstein, and Peter J. Figura, "Intermediate fire severity diversity promotes richness of forest carnivores in California," *Diversity and Distributions* (2021).
[96] Kelly et al., "Fire and biodiversity in the Anthropocene."
[97] Stanley Clifton Cunningham et al., "Black bear habitat use in burned and unburned areas, central Arizona," *Wildlife Society Bulletin* 31 (2003).
[98] Furnas, Goldstein, and Figura, "Intermediate fire severity diversity promotes richness of forest carnivores in California."Citing Van de Water and Safford 2011.
[99] Furnas, Goldstein, and Figura, "Intermediate fire severity diversity promotes richness of forest carnivores in California."Citing Beaty & Taylor 2007 and Youngblood et al. 2004.
[100] Furnas, Goldstein, and Figura, "Intermediate fire severity diversity promotes richness of forest carnivores in California."Citing McIntyre et al. 2015.
[101] Jesse S. Lewis et al., "Mixed-severity wildfire shapes habitat use of large herbivores and carnivores," *Forest Ecology and Management* 506 (2022).
[102] Emphasis added. Lewis et al., "Mixed-severity wildfire shapes habitat use of large herbivores and carnivores," p. 2.

timescale.[103] Furnas et al. (2021) found that frequent, low severity fires provide short-term benefits for carnivores, with about a "10-year pulse" of increased growing space for plants that feed bears (omnivorous carnivores) and small mammal prey (thus providing indirect benefits to obligate carnivores).[104] Furnas et al. (2021) add that, "Low severity fire can also create forest openings, snags and logs while retaining large diameter overstorey trees"[105] – the denning habitat preferred by bears in some ecosystems.[106] However, the 2022 New Mexico fires were not "low-severity fires,"[107] but were instead "'trans-apocalyptic'"[108]—leaving moonscapes for cougars and other wildlife with which to attempt to cope.

9. Cougar hunting does not reduce conflicts in the long-term, and, in fact, may exacerbate them

Because of their lack of hunting skills, orphaned kittens or young dispersing animals are the individuals most likely to have negative encounters with humans or livestock.[109] For these reasons, reducing the mortalities of resident adult animals is essential in preventing human-cougar conflicts: Adult cougars kill dispersing young animals (the ones most likely involved in livestock or human conflicts), and without persecution, adult cougars can care for their young; the young are not orphaned before they learn to hunt optimal, but dangerous, prey (ungulates).

Elbroch and Quigley (2012) set out a remote camera on an injured fawn (who was presumably injured by the mother cougar). Twenty minutes of video showed that a 12-month-old kitten could not dispatch the fawn. Elbroch and Quigley (2012) suggest that kittens are likely unable to survive on their own until they are, on average, 17.5 months old.[110] In later work, they investigated how age and body size determines vulnerability of different prey.[111] Orphaned cougar kittens or dispersing subadults are the animals most likely involved in conflicts with people, pets and livestock.[112] Elbroch and Quigley (2012) write:

> Linnell et al. (1999) suggested that younger animals with unrefined hunting skills were more likely to attack livestock. Sixty-seven percent of 9 cougars in a Montana study (Aune 1991) and 33% of 286 cougars in a California study (Torres et al. 1996) involved in depredation activity were less than two years old. Further, young Cougars are more likely to attack humans (Beier 1991). Our observations provide evidence that Cougars up to 12 months of age are unlikely to have developed the full set of requisite skills needed to efficiently dispatch prey, and suggest that managers should consider both mitigating the potential for orphaned kittens as well as preparing to take action to mitigate potential problems caused by orphaned kittens.[113]

Hunting dangerous prey such as large ungulates can be fatal to cougars.[114] Cougar can die from puncture wounds inflicted by ungulates' antlers, or they can be slammed into trees or branches while trying to subdue large prey animals, resulting in injury or death.[115] Because of these dangers, cougars select for prey based upon several factors

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[103] Furnas, Goldstein, and Figura, "Intermediate fire severity diversity promotes richness of forest carnivores in California."
[104] Furnas, Goldstein, and Figura, "Intermediate fire severity diversity promotes richness of forest carnivores in California."Citing Amacher et al. 2008, Roberts et al. 2015, Kelleyhouse 1980 and Swanson et al. 2010.
[105] Furnas, Goldstein, and Figura, "Intermediate fire severity diversity promotes richness of forest carnivores in California."
[106] Furnas, Goldstein, and Figura, "Intermediate fire severity diversity promotes richness of forest carnivores in California."(Citing Agee 1998).
[107] Furnas, Goldstein, and Figura, "Intermediate fire severity diversity promotes richness of forest carnivores in California."
[108] Elizabeth Well, "This Isn't the California I Married," *The New York Times* (https://www.nytimes.com/2022/01/03/magazine/california-widfires.html?action=click&module=RelatedLinks&pgtype=Article), Jan. 3, 2022.
[109] Elbroch and Quigley, "Observations of Wild Cougar (Puma concolor) Kittens with Live Prey: Implications for Learning and Survival."; Mattson, Logan, and Sweanor, "Factors governing risk of cougar attacks on humans."; Mattson, Logan, and Sweanor, "Factors governing risk of cougar attacks on humans."
[110] Elbroch and Quigley, "Observations of Wild Cougar (Puma concolor) Kittens with Live Prey: Implications for Learning and Survival."
[111] Elbroch, Feltner, and Quigley, "Stage-dependent puma predation on dangerous prey."
[112] Elbroch and Quigley, "Observations of Wild Cougar (Puma concolor) Kittens with Live Prey: Implications for Learning and Survival."; Elbroch and Treves, "Perspective: Why might removing carnivores maintain or increase risks for domestic animals?."
[113] Elbroch and Quigley, "Observations of Wild Cougar (Puma concolor) Kittens with Live Prey: Implications for Learning and Survival,", p. 334.
[114] Elbroch, Feltner, and Quigley, "Stage-dependent puma predation on dangerous prey."
[115] Elbroch, Feltner, and Quigley, "Stage-dependent puma predation on dangerous prey."; Murphy and Ruth, "Diet and Prey Selection of a Perfect Predator."; J. Polisar et al., "Jaguars, pumas, their prey base, and cattle ranching: ecological interpretations of a management problem," *Biological Conservation* 109, no. 2 (2003).

including their age and body size.[116] Yet, Elbroch et al. (2017) found that some cougars, with less experience but are suffering from hunger, are "those most likely to engage dangerous prey."[117] Young, dispersing cougars, Elbroch et al. (2017) write, "suffer low social rank in encounters with resident adults, and exhibit greater mortality rates than established adults."[118] Because orphaned and subadult cougars may pose a risk to livestock producers, non-lethal actions can and should be undertaken.

Wildlife managers can work proactively with livestock operators to ensure their animals are safeguarded from conflicts with wildlife. Installing predator-proof enclosures, using livestock guardian animals, or utilizing frightening devices are all effective strategies to prevent conflicts with cougars and other carnivores. Other livestock husbandry practices are also essential at reducing conflicts with carnivores. Livestock operators should:

- Keep livestock, especially maternity pastures, away from areas where wild cats have access to ambush cover.[119]
- Keep livestock, especially the most vulnerable—young animals, mothers during birthing seasons and hobby-farm animals—behind barriers such as electric fencing and/or in barns or pens or kennels with a top.[120] The type of enclosure needs to be specific for the predator to prevent climbing, digging or jumping.[121]
- Move calves from pastures with chronic predation problems and replace them with older, less vulnerable animals.[122]
- Concentrate calving season (i.e., via artificial insemination) to synchronize births with wild ungulate birth periods.[123]
- In large landscapes, use human herders, range riders and/or guard animals.[124] Guard dogs work better when sheep and lambs are contained in a fenced enclosure rather than on open range lands where they can wander unrestrained.[125]
- Suspended clothing, LED flashing lights (sold as "Foxlights") and radio alarm boxes set off to make alarm sounds/noises near pastures are some of the low-cost sound and or visual equipment that deters wild cats.[126]

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[116] Elbroch, Feltner, and Quigley, "Stage-dependent puma predation on dangerous prey."
[117] Elbroch, Feltner, and Quigley, "Stage-dependent puma predation on dangerous prey," 1.
[118] Elbroch, Feltner, and Quigley, "Stage-dependent puma predation on dangerous prey." Elbroch et al. 2017 citing Logan and Sweanor (2010) and Ruth et al. 2011); Polisar et al., "Jaguars, pumas, their prey base, and cattle ranching: ecological interpretations of a management problem."
[119] J. Polisar et al., "Jaguars, pumas, their prey base, and cattle ranching: ecological interpretations of a management problem," *Biol Conserv* 109 (2003), https://doi.org/10.1016/s0006-3207(02)00157-x, http://dx.doi.org/10.1016/S0006-3207(02)00157-X; J. A. Shivik, A. Treves, and P. Callahan, "Nonlethal techniques for managing predation: Primary and secondary repellents," *Conservation Biology* 17, no. 6 (2003); A. Treves and K. U. Karanth, "Special section: Human-carnivore conflict: Local solutions with global applications," Editorial Material, *Conservation Biology* 17, no. 6 (Dec 2003), <Go to ISI>://000186869700008 ; A. Treves and K. U. Karanth, "Human-carnivore conflict and perspectives on carnivore management worldwide," *Conservation Biology* 17, no. 6 (2003).
[120] S. A. Stone et al., "Adaptive use of nonlethal strategies for minimizing wolf-sheep conflict in Idaho," *Journal of Mammalogy* 98, no. 1 (2017); Treves and Karanth, "Human-carnivore conflict and perspectives on carnivore management worldwide."; William F. Andelt, "Carnivores," in *Rangeland Wildlife*, ed. P. R. Krausman (Denver: Society for Range Management, 1996).
[121] A. Eklund et al., "Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores," *Scientific Reports* 7 (2017).
[122] Polisar, J., et al. 2003.
[123] Polisar, J., et al. 2003.
[124] Treves and Karanth, "Special section: Human-carnivore conflict: Local solutions with global applications."; Treves and Karanth, "Human-carnivore conflict and perspectives on carnivore management worldwide." Eklund et al., "Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores." Stone et al., "Adaptive use of nonlethal strategies for minimizing wolf-sheep conflict in Idaho." M. Parks and T. Messmer, "Participant perceptions of Range Rider Programs operating to mitigate wolf-livestock conflicts in the western United States," *Wildlife Society Bulletin* 40, no. 3 (2016); W. F. Andelt, "Effectiveness of livestock guarding dogs for reducing predation on domestic sheep," *Wildlife Society Bulletin* 20 (1992); W. F. Andelt and S. N. Hopper, "Livestock guard dogs reduce predation on domestic sheep in Colorado," *Journal of Range Management* (2000).
[125] Eklund et al., "Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores."
[126] M. M. Zarco-Gonzalez and O. Monroy-Vilchis, "Effectiveness of low-cost deterrents in decreasing livestock predation by felids: a case in Central Mexico," *Animal Conservation* 17, no. 4 (2014). Stone et al., "Adaptive use of nonlethal strategies for minimizing wolf-sheep conflict in Idaho." N. J. Lance et al., "Biological, technical, and social aspects of applying electrified fladry for livestock protection from wolves (Canis lupus)," *Wildlife Research* 37, no. 8 (2010); Shivik, Treves, and Callahan, "Nonlethal techniques for managing predation: Primary and secondary repellents."

In sum, New Mexico needs to increase non-lethal measures to reduce human-cougar conflicts and not rely on trophy hunting or predator control so that cougars can be conserved for future generations.

10. Permitting cougar hounding will expose the Department and Commission to liability under the federal Endangered Species Act

Authorizing private citizens to hunt black bears and cougars with the aid of hounds risks causing unlawful take of federally protected Mexican wolves (aka *lobos*) that will expose the Department and Commission to liability under the Endangered Species Act. Occupied Mexican wolf range in New Mexico overlaps substantially with occupied black bear and cougar ranges where hound hunting will be permitted under the proposed rule. Encounters between Mexican wolves and hunting hounds have already been reported in Arizona and New Mexico, and more will inevitably occur if hound hunting is authorized in Mexican wolf range. Hounding facilitates wolf poaching.[127] The risk of contact is magnified when dogs roam beyond the visual or auditory range of hunters.[128] Dogs used to hound bears or cougars often run some distance beyond this range, potentially straying into wolf rendezvous or den sites or other areas where wolves are concentrated.[129] Additionally, the baying sounds made by dogs while hounding can draw territorial wolves, who may interpret these noises as a challenge.[130] Wisconsin allows extensive hound hunting, resulting in negative interactions with wolves who guard food resources and pups from the hounds.[131] Yet other than documenting one incident,[132] Wisconsin officials have failed to collect comprehensive data on how many wolves or non-target animals have been harmed by hounds in the state.[133] Additionally, encounters with hunting hounds can disturb essential behavioral patterns[134] and result in the transfer of disease from hounds to Mexican wolves, including distemper and parvovirus, both deadly canid diseases.[135]

Hounding black bears and cougars constitutes "take" under the federal Endangered Species Act ("ESA"). Section 9 of the ESA prohibits the unauthorized "take" of an endangered species. 16 U.S.C. 1538(a)(1)(B). The ESA defines "take" to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct." Id. § 1532(19). "Take" includes direct as well as indirect harm and need not be purposeful. See Babbit v. Sweet Home Chapter of Communities for a Great Oregon, 515 U.S. 687, 704 (1995). A take may even be the result of an accident. See National Wildlife Federation v. Burlington Northern Railroad, 23 F.3d 1508, 1512 (9th Cir. 1994).

The ESA's take prohibition applies equally to threatened species and members of experimental populations, unless otherwise indicated by a species-specific rule promulgated by the FWS pursuant to ESA § 4(d). See 50 C.F.R. 17.31(a). The species-specific rule for Mexican wolves allows for no exception to the prohibition on take caused by hounds. 50 C.F.R. 17.84(k)(5). Accordingly, the ESA protects Mexican wolves from take or attempted take caused by hounds.

These ESA protections apply equally against hounding authorized by a state official or agency. It is unlawful for any person to "cause [an ESA violation] to be committed." 16 U.S.C. § 1538(g). The term "person" includes "any officer, employee, agent, department, or instrumentality … of any State, municipality, or political subdivision of a State … [or] any State, municipality, or political subdivision of a State …." Id. § 1532(13). Thus, the ESA "not only prohibits the acts of those parties that directly exact the taking, but also bans those acts of a third party that bring about the acts exacting a taking…. [A] governmental third party pursuant to whose authority an actor directly exacts

[127] Francisco J. Santiago-Ávila and Adrian Treves, "Poaching of protected wolves fluctuated seasonally and with non-wolf hunting," *Scientific Reports* 12, no. 1 (2022).
[128] Adrian. P. Wydeven et al., "Characteristic of wolf packs in Wisconsin: Identification of traits influencing depredation," in *People and predators: From conflicts to coexistence*, ed. Nina Fascione, Aimee Delach, and Martin E. Smith (Washington, D.C.: Island Press, 2004).
[129] "Guidance for hunters and pet owners: reducing conflicts between wolves and dogs," 2023.
[130] Wisconsin Department of Natural Resources, "Guidance for hunters and pet owners: reducing conflicts between wolves and dogs."
[131] Adrian Treves and Laura Menefee, "Adverse effects of hunting with hounds on participants and bystanders," *bioRxiv* (2022); J. K. Bump et al., "Bear-Baiting May Exacerbate Wolf-Hunting Dog Conflict," *Plos One* 8, no. 4 (2013); Treves and Menefee, "Adverse effects of hunting with hounds on participants and bystanders."
[132] Randy Johnson and Anna Schneider, "Wisconsin Wolf Season Report: February 2021," *https://widnr.widen.net/s/k8vtcgjwkf/wolf-season-report-february-2021* (2021).
[133] Treves and Menefee, "Adverse effects of hunting with hounds on participants and bystanders."
[134] Wydeven et al., "Characteristic of wolf packs in Wisconsin: Identification of traits influencing depredation," , p. 41.
[135] Philip W. Hedrick, Rhonda N. Lee, and Colleen Buchanan, "Canine Parvovirus Enteritis, Canine Distemper, and Major Histocompatibility Complex Genetic Variation in Mexican Wolves," *Journal of Wildlife Diseases* 39, no. 4 (2003).

a taking … may be deemed to have violated the provisions of the ESA." Strahan v. Coxe, 127 F.3d 155, 163 (1st Cir. 1997) (emphasis added) (holding that Massachusetts exacted a taking by issuing licenses and permits authorizing gillnet and lobster pot fishing—activities known to incidentally injure Northern right whales). As in Strahan, state hunting and trapping schemes violate the ESA's section 9 prohibition on take when "a risk of taking exists [even] if trappers comply with all applicable laws and regulations in place." Animal Prot. Inst., Ctr. for Biological Diversity v. Holsten, 541 F. Supp. 2d 1073, 1079 (D. Minn. 2008) (holding Commissioner of the Minnesota Department of Natural Resources liable for incidental killing of lynx); see also Strahan v. Sec'y, Massachusetts Exec. Off. of Energy & Envtl. Affs., 458 F. Supp. 3d 76, 95 (D. Mass. 2020)(holding Massachusetts Executive Office of Energy and Environmental Affairs and Director of Massachusetts Division of Marine Fisheries liable for incidental trapping of Northern right whales); Ctr. for Biological Diversity v. C.L. Otter, No. 1:14-CV-258-BLW, 2016 WL 233193 (D. Idaho Jan. 8, 2016) (holding Idaho Governor and others liable for incidental trapping of lynx), on reconsideration, sub nom. Ctr. for Biological Diversity v. Otter, No. 1:14-CV-258-BLW, 2018 WL 539329 (D. Idaho Jan. 24, 2018); Red Wolf Coal. v. N. Carolina Wildlife Res. Comm'n, No. 2:13-CV-60-BO, 2014 WL 1922234 (E.D.N.C. May 13, 2014) (holding North Carolina Wildlife Resources Commission liable for incidental take of red wolves).

In short, using hunting hounds results in the illegal take of Mexican wolves and facilitates more lobo poaching.

11. New Mexico should abolish hounding as a legal hunting method because it inflicts unnecessary stress, injury and suffering on cougars and non-target wildlife

In numerous studies, both the general public and hunters themselves object to hunting activities that are viewed as unfair, unsporting, inhumane or unsustainable. Many hunting advocates condemn such actions as a violation of the hunter's ethical code because methods like bear hounding are not perceived as "fair chase" hunting.[136]

In his book Beyond Fair Chase: The Ethic and Tradition of Hunting, Jim Posewitz explained the concept of fair chase: "The ethical hunter must make many fair-chase choices . . . luring animals with bait or hunting in certain seasons sometimes is viewed as giving unfair advantage to the hunter. If there is a doubt, advantage must be given to the animal being hunted."

Hounding, which is using packs of dogs to pursue cougars, is considered unsporting even among many hunters because it gives unfair advantage to the hunter.[137] What's more, those packs of virtually monitored, GPS radio-collared hounds can harm, disturb, maul or kill wildlife including bear cubs, Mexican gray wolves, deer fawns and ground-nesting birds.[138] Hounds kill kittens, and cougars often injure or kill hounds.[139] Using radio-collared trailing hounds to chase cougars and bobcats to bay them into trees or rock ledges, so a trophy hunter can shoot these cats at close range, is unsporting, unethical and inhumane.[140]

Just as heavily hunted wolves exhibit higher stress responses than lightly-hunted wolf populations,[141] cougars who are repeatedly chased by hounds indicate a much higher stress response than those who had been chased only once.[142] Stress, which depletes the adrenals and lowers cortisol levels, could have debilitating effects on an individual cougar.[143] Bonier et al. (2006) found that adrenal and behavioral responses to stress are linked and, citing others,

[136] J. Posewitz, *Beyond Fair Chase: The Ethic and Tradition of Hunting* (Helena, Montana: Falcon Press, 1994).
[137] T. L. Teel, R. S. Krannich, and R. H. Schmidt, "Utah stakeholders' attitudes toward selected cougar and black bear management practices," *Wildlife Society Bulletin* 30, no. 1 (2002).
[138] Hank Hristienko and Jr. McDonald, John E., "Going in the 21st century: a perspective on trends and controversies in the management of the black bear " *Ursus* 18, no. 1 (2007); Stefano Grignolio et al., "Effects of hunting with hounds on a non-target species living on the edge of a protected area," *Biological Conservation* 144, no. 1 (2011); Emiliano Mori, "Porcupines in the landscape of fear: effect of hunting with dogs on the behaviour of a non-target species," *Mammal Research* 62, no. 3 (2017).
[139] L. M. Elbroch et al., "Trailing hounds vs foot snares: comparing injuries to pumas Puma concolor captured in Chilean Patagonia," *Wildlife Biology* 19, no. 2 (2013); Logan and Sweanor, *Desert puma: evolutionary ecology and conservation of an enduring carnivore*; F. G. Lindzey et al., "Cougar Population Response to Manipulation in Southern Utah," *Wildlife Society Bulletin* 20, no. 2 (1992).
[140] Teel, Krannich, and Schmidt, "Utah stakeholders' attitudes toward selected cougar and black bear management practices."
[141] Heather M. Bryan et al., "Heavily hunted wolves have higher stress and reproductive steroids than wolves with lower hunting pressure," *Functional Ecology* (2014).
[142] Henry J. Harlow et al., "Stress response of cougars to nonlethal pursuit by hunters," *Canadian Journal of Zoology* 70, no. 1 (1992). F. Bonier, H. Quigley, and S. N. Austad, "A technique for non-invasively detecting stress response in cougars," *Wildlife Society Bulletin* 32, no. 3 (2004).
[143] Harlow et al., "Stress response of cougars to nonlethal pursuit by hunters."

found that chronic stress could potentially harm a stressed individual's reproductive, digestive and immune systems.[144]

Bryce et al. (2017) found that while hounds are "endurance athletes" because of their large lung and heart sizes, the chase was energetically costly for hounded cougars. To escape from the hounds, cougars had to use several evasive maneuvers such as running in figure eights, scrambling up trees or steep hillsides and quick turns to evade the hounds. As a result, cougars could exceed their aerobic budgets, causing their muscles to go anaerobic, while the hounds typically ran at a relatively steady pace with little ill effect.[145] Every one minute the hounds chased the cougar cost that cougar approximately 4.64 times more energy than would have expended if the cougar had been hunting for food. A 3.5-minute chase, according to the Bryce et al. (2017), likely equaled 18 minutes of energy the cougar would have expended on hunting activities necessary to find prey.[146] Pursuit during hot weather can cause physical stress to both dogs and cougars.[147]

Because hounding is so fraught with ethical problems and ESA issues, NMDGF must eliminate cougar hounding in New Mexico.

12. Family oriented cougars hold intrinsic value, and provide incalculable benefits to their ecosystems

With the advancement of remote, motion-detecting cameras, researchers can learn more about the secret lives of cougars.[148] They are far more social than researchers had believed. A territorial male maintains a network of cougars, his mates and offspring, who he protects in return for food provided by his females.[149] And those females will share kills with other "sister" females and their sister's kittens.[150] This food sharing promotes kinship and reduces "rapid kleptoparasitism" by scavengers, including by coyotes and black bears.[151]

Cougars are also ecologically valuable. In Zion National Park, researchers found that by modulating deer populations, cougars prevented overgrazing near fragile riparian systems. The result: more cottonwoods, rushes, cattails, wildflowers, amphibians, lizards, and butterflies, and deeper, but narrower, stream channels.[152] Cougars' kills also leave tremendous amounts of meat for other species including black bears, wolves and eagles.[153] Cougars enhance the biological diversity of their ecosystems, including the health of other imperiled species and leave even more carrion than wolves for other species to feed upon.[154]

Cougars help ungulate populations by preying on sick individuals, reducing the spread of disease such as brucellosis and chronic wasting disease (CWD).[155] This ecosystem service is increasingly important as CWD infection continues

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144 Bonier, Quigley, and Austad, "A technique for non-invasively detecting stress response in cougars."
145 Caleb M. Bryce, Christopher C. Wilmers, and Terrie M. Williams, "Energetics and evasion dynamics of large predators and prey: pumas vs. hounds," *PeerJ* 5 (2017).
146 Bryce, Wilmers, and Williams, "Energetics and evasion dynamics of large predators and prey: pumas vs. hounds," 9.
147 Hristienko and McDonald, "Going in the 21st century: a perspective on trends and controversies in the management of the black bear ".
148 See e.g., National Geographic, "Cameras Reveal the Secret Lives of a Mountain Lion Family." https://www.youtube.com/watch?v=utK9mhiN56M <last viewed July 11, 2023>
149 L. Mark Elbroch et al., "Adaptive social strategies in a solitary carnivore," *Science Advances* 3, no. 10 (2017).
150 Elbroch et al., "Adaptive social strategies in a solitary carnivore."
151 Elbroch et al., "Adaptive social strategies in a solitary carnivore."
152 W.J. Ripple and R.L. Beschta, "Linking a cougar decline, trophic cascade, and catastrophic regime shift in Zion National Park," *Biological Conservation* 133 (2006).
153 L. Mark Elbroch and Heiko U. Wittmer, "Table scraps: inter-trophic food provisioning by pumas," *Biology letters* 8, no. 5 (2012); Maximilian L. Allen et al., "The Comparative Effects of Large Carnivores on the Acquisition of Carrion by Scavengers," *The American Naturalist* 185, no. 6 (2015); L. Mark Elbroch et al., "Vertebrate diversity benefiting from carrion provided by pumas and other subordinate, apex felids," *Biological Conservation* 215 (2017); Maximilian L. Allen, L. Mark Elbroch, and Heiko U. Wittmer, "Can't bear the competition: Energetic losses from kleptoparasitism by a dominant scavenger may alter foraging behaviors of an apex predator," *Basic and Applied Ecology* 51 (2021).
154 Elbroch et al., "Vertebrate diversity benefiting from carrion provided by pumas and other subordinate, apex felids."
155 Ellen E. Brandell et al., "Examination of the interaction between age-specific predation and chronic disease in the Greater Yellowstone Ecosystem," *Journal of Animal Ecology* (2022); C. E. Krumm et al., "Mountain lions prey selectively on prion-infected mule deer," *Biology Letters* 6, no. 2 (2009).

to infiltrate ungulate herds in New Mexico and neighboring states.[156] Hunters likely cannot substitute for cougars as providers of ecological services such as stopping the spread of disease.[157] During a three-year study on Colorado's Front Range, researchers found that cougars preyed on mule deer infected with CWD.[158] The study concluded that adult mule deer preyed upon by cougars were more likely to have CWD than deer shot by hunters. According to the study, "The subtle behavioral changes in prion-infected deer may be better signals of vulnerability than body condition, and these cues may occur well before body condition noticeably declines."[159] This suggests that cougars select for infected prey and may be more effective at culling animals with CWD than hunters who rely on more obvious signs of emaciation that occur in later stages of the disease. Moreover, the cougars consumed over 85% of carcasses, including brains, removing a significant amount of contamination from the environment.[160]

In sum, cougars are highly intelligent, family-oriented animals who are also vital to their ecosystems, including their prey.

13. New Mexicans' wildlife values should be measured using social science, and their views respected

In the past, NMDGF used the term "social carrying capacity" to inform its bear management protocols. But the term "social carrying capacity" is arbitrary and unsupported by peer-reviewed science, and therefore should be dropped if it is still in use by NMDGF.

Americans believe that cougars hold intrinsic value; that is, cougars are inherently valuable beyond their benefits to society or even their ecosystems. A 2019 study of adult U.S. residents also found that 81% believe that wildlife hold intrinsic value.[161] As Bruskotter et al. (2015) write, ". . . most people believe that wildlife possess 'intrinsic value,' which suggests that wildlife should be treated with regard for their own welfare, not just their utility (or lack thereof) to humans."[162] Cougars have more value alive than dead, and a vast majority of Americans agree that wildlife have intrinsic value independent of their utility to people. This is another reason that cougar conservation, not hunting, should be the focus of their management in New Mexico.

- In 2019, the National Shooting Sports Foundation and Responsive Management—both pro-hunting and -trapping entities—found that 66% of Americans disapprove of trophy hunting.[163]
- More than two dozen polls commissioned by the Humane Society of the United States have found that about two-thirds of Americans dislike trophy hunting, and some of the polls specifically queried the public about cougar hunting and found similar opposition.[164]

According to the U.S. Fish and Wildlife Service, only 6.6% of New Mexico residents held paid hunting licenses in 2023.[165] And of that small percentage, a much smaller number are trophy hunters (about 2% of all hunters)—who, according to a 2020 economic study, depend largely on funding provided by others to continue their hobby.[166] Trophy hunting of cougars is unpopular. Trophy hunters' primary motivation is to kill cougars for photo opportunities and to

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[156] U.S. Geological Survey. 2018. Chronic Wasting Disease map Jan 2018. Retrieved from https://www.usgs.gov/media/images/chronic-wasting-disease-map-jan-2018.
[157] Chris T. Darimont et al., "The unique ecology of human predators," *Science* 349, no. 6250 (2015).
[158] Krumm et al., "Mountain lions prey selectively on prion-infected mule deer."
[159] Krumm et al., "Mountain lions prey selectively on prion-infected mule deer.", p. 210
[160] Krumm et al., "Mountain lions prey selectively on prion-infected mule deer."
[161] J.T. Bruskotter, M.P. Nelson, and J.A Vucetich, "Does nature possess intrinsic value? An empirical assessment of Americans' beliefs.," (2015).
[162] J. T. Bruskotter, M. P. Nelson, and J. A. Vucetich, "Hunted predators: Intrinsic value," *Science* 349, no. 6254 (2015).
[163] National Shooting Sports Foundation and Responsive Management, "Americans' attitudes toward hunting, fishing, sport shooting and trapping 2019," (2019).
[164] Remington Research Group, "Colorado Statewide Public Opinion (black bear, mountain lion and bobcat)," (Dec. 2020); Remington Research Group, "Colorado Public Opinion (trapping & trophy hunting wild cats and bears)," (2021); Remington Research Group, "National public opinion (on trophy hunting)," *https://www.humanesociety.org/sites/default/files/docs/HSUS_Trophy-Hunting-National-Public-Opinion-01-10-22.pdf* (2022).
[165] U.S. Fish and Wildlife Service, "Hunting licenses, holders and costs by apportionment year," *https://us-east-1.quicksight.aws.amazon.com/sn/accounts/329180516311/dashboards/48b2aa9c-43a9-4ea6-887e-5465bd70140b* (2023).
[166] Cameron Murray, "Trophy hunters of native carnivores benefit from wildlife conservation funded by others," *A report for the Humane Society of the United States* https://www.humanesociety.org/sites/default/files/docs/HSUS_Trophy-Hunting-Economics-2020.pdf (2020).

obtain and display body parts, including heads, hides and claws.[167] Trophy hunters kill animals *primarily* for bragging rights, but not for food. Hunting large carnivores for food is unsustainable.[168] Darimont et al. (2017) write:

> First, inedible species, like carnivores commonly targeted by trophy hunters, make nutritional and sharing hypotheses implausible. Second, evidence for show-off behaviour appears clear. Trophy hunters commonly pose for photographs with their prey, with the heads, hides and ornamentation prepared for display.[169]

What Americans value are efforts to co-exist with wildlife, even wildlife Americans historically believed were "scary."[170]

According to the Bureau of Economic Analysis-Department of Commerce, outdoor recreation in New Mexico generated $2.3 billion for the state's economy in 2021. Fig. 3. Of that figure, hunting and trapping generated $8,418,000 ($8.4 million), which equals about 0.4% of the total outdoor recreation dollars spent in New Mexico. Skiing and snowboarding generated $39,421,000—about five times more than hunting and trapping. And people spent 94 times more on travel and tourism in New Mexico than on hunting and trapping.[171] Fig. 3.

Fig. 3. Outdoor recreation spending in New Mexico (2021), Data from U.S. Bureau of Econ. Analysis, show that hunters and trappers spend a mere 0.4% of all outdoor recreation in New Mexico.

Sample activities	Spending [thousands of dollars]	% of total
Hunting and trapping	8,418	**0.4**
Climbing, hiking, tent camping	22,322	**1.0**
Skiing and snowboarding	39,421	**1.7**
Equestrian	53,536	**2.3**
Travel and tourism	788,269	**34.6**
Total Outdoor Recreation	2,279,181	**100.0**

New Mexico's wildlife agency is poorly funded, too. Southwick Associates (2021) write that New Mexico is "lagging behind other western states" in "identifying stable conservation funding." Its future needs for funding are between $37.5 million to $48.4 million annually, but the agency is only achieving "below $10.2 million annual funding level."[172]

New Mexico must seek out new ways to broaden its funding sources. For example, in 2022 the Colorado Legislature passed a law to fund Colorado Parks and Wildlife (CPW). **The Keep Colorado Wild Pass**, allows motorists registering their vehicles to opt into a low cost, $29 per year parks pass. The law is expected to generate a new $36 million annually to CPW.[173] The agency states, "The first $32.5 million will go toward state park maintenance and development, the next $2.5 million will go towards search and rescue teams and $1 million to the Colorado Avalanche Information Center. Any revenue beyond that will go to wildlife projects and outdoor educational programs." Extra funds will go toward

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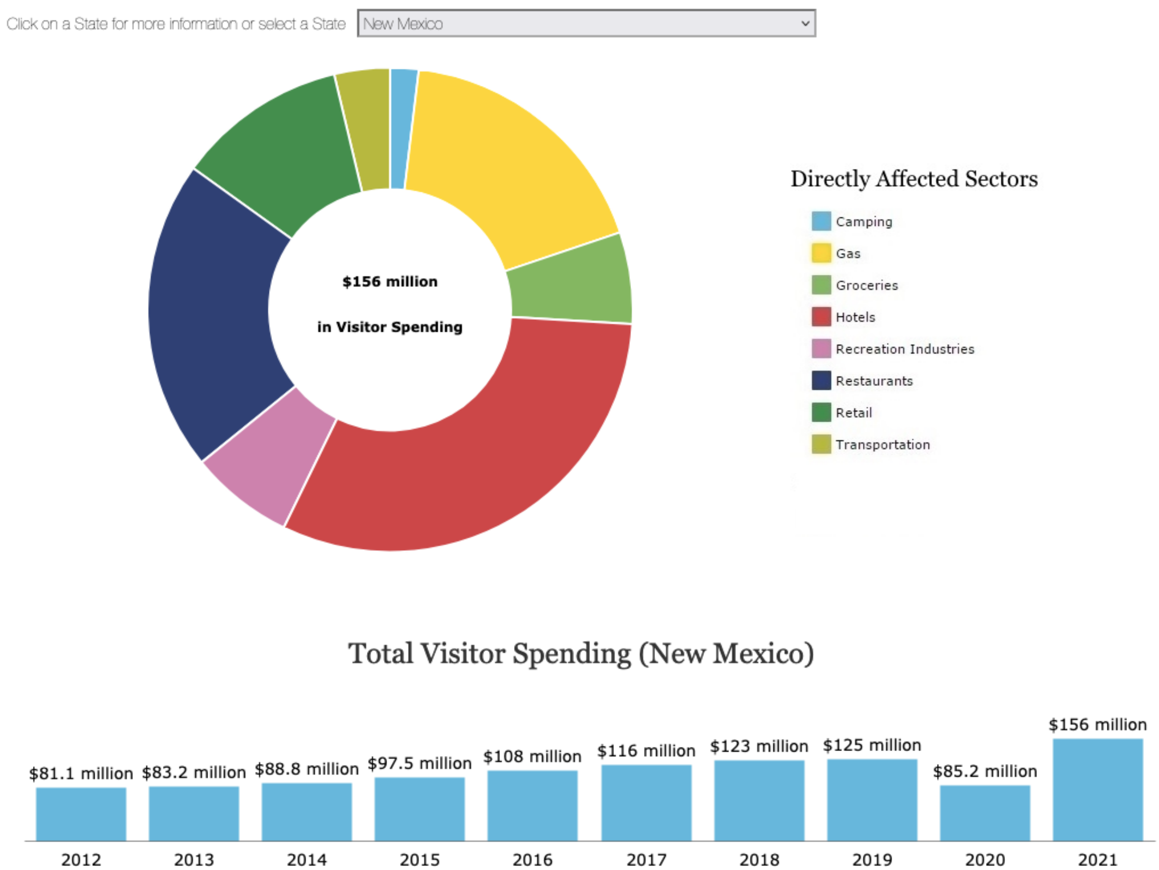
[167] Chris T. Darimont, Brian F. Codding, and Kristen Hawkes, "Why men trophy hunt," *Biology Letters* 13, no. 3 (2017).; Chelsea Batavia et al., "The elephant (head) in the room: A critical look at trophy hunting," *Conservation Letters* (2018).
[168] Darimont et al., "The unique ecology of human predators."
[169] Darimont, Codding, and Hawkes, "Why men trophy hunt."
[170] M. J. Manfredo et al., America's Wildlife Values: The Social Context of Wildlife Management in the U.S., (Fort Collins, Colorado: Colorado State University, Department of Natural Resources, 2018); Michael J. Manfredo et al., "Social value shift in favour of biodiversity conservation in the United States," *Nature Sustainability* 4, no. 4 (2021); Kelly A. George et al., "Changes in attitudes toward animals in the United States from 1978 to 2014," *Biological Conservation* 201 (2016).
[171] Dept. of Commerce Bureau of Economic Analysis, "Outdoor Recreation Satellite Account, U.S. and Prototype for States, 2023," *https://www.bea.gov/data/special-topics/outdoor-recreation* (2023).
[172] Southwick Associates, "New Mexico Department of Game and Fish Future Funding Study," *https://www.wildlife.state.nm.us/download/publications/reports-studies/New-Mexico-Department-of-Game-and-Fish-Future-Funding-Study.pdf* (2021).
[173] Colorado Parks and Wildlife, "Keep Colorado Wild Pass," *https://cpw.state.co.us/aboutus/Pages/Keep-Colorado-Wild-Pass.aspx?utm_source=digital&utm_medium=google&utm_campaign=2022-keepcoloradowild-digital&gclid=Cj0KCQjw756lBhDMARIsAEI0AgkmhxaO764WnwYV0ErrAf49AE21U_IGmrf84PhVDRPLPZcnDam6PlkaAo75EALw_wcB*.

administering the state wildlife action plan to conserve rare, threatened, and endangered species.[174] New Mexico could achieve a similar program. As BEA and National Park Service data show, New Mexicans are committed to outdoor recreation. The National Park Service's 2023 data show that a record 156 million dollars was spent by visitors to New Mexico's national park gateway regions in 2021. Fig. 3. The NPS writes:

> In 2021, 2.4 million park visitors spent an estimated $156 million in local gateway regions while visiting National Park Service lands in New Mexico. These expenditures supported a total of 2,080 jobs, $61.9 million in labor income, $106 million in value added, and $196 million in economic output in the New Mexico economy. [175]

Fig. 4. Visitor spending in New Mexico's national parks from 2012 to 2021.



Lastly, we know from numerous studies that wildlife watching tourism is lucrative and brings in exponentially more money than hunting or trapping wildlife.[176] To put it simply, once an animal is killed, no one else has the opportunity to view or photograph that animal.

In sum, wildlife watchers and other non-hunting-related outdoor recreationists are the biggest contributors to New Mexico's economy when compared with funds from the hunting and trapping community. Most New Mexicans do not approve of cougar hunting, which is trophy hunting. New Mexico could adopt a vehicle registration program that would help the state to fund its parks and wildlife projects from the mainstream public.

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[174] Colorado Parks and Wildlife, "Keep Colorado Wild Pass."

[175] National Park Service, "National Park Spending Effects (2021)," *https://www.nps.gov/subjects/socialscience/vse.htm* (2023).

[176] Leslie Richardson et al., "The economics of roadside bear viewing," *Journal of Environmental Management* 140 (2014); John Loomis et al., "A method to value nature-related webcam viewing: the value of virtual use with application to brown bear webcam viewing," *Journal of Environmental Economics and Policy* 7, no. 4 (2018); Martha Honey et al., "Economic impact of bear viewing and bear hunting: The Great Bear Rainforest of British Columbia," (2014); L. M. Elbroch et al., "Contrasting bobcat values," *Biological Conservation* (2017).

14. Conclusion

Because of many human-caused factors, life for New Mexico's rare and iconic cougars is becoming increasingly difficult. They face habitat loss, severe fires, and diminishing food sources and travel corridors. Much more must be done to protect and conserve them. NMDGF's proposed quotas fail to conform to the best available science and must be drastically reduced. All cougar mortality in New Mexico must count toward those quotas. NMDGF must produce a well-reasoned cougar management plan. For all these reasons we ask that you take these comments into consideration. Thank you for this opportunity to provide public comment.

Sincerely yours,

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