COLORADO
Parks and Wildlife
Department of Natural Resources

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MEMORANDUM

TO: Parks and Wildlife Commissioners

FROM: Reid DeWalt, Deputy Director

DATE: December 31, 2024

SUBJECT: Supplemental information for the Wolf Program Update

This memo is intended to provide supplemental information to the Wolf Program Update (Agenda Item 13a), which will be presented on Wednesday, January 8, 2025.

The first item included in this memo includes the current version of the Site Assessment form. The form will be included in the presentation, but there is not adequate time to cover all the questions that are included on the form. The form is being provided to you via this memo to allow you to become familiar with it prior to the presentation.

Second, there has been a significant amount of research over the last several decades that has been conducted on the effectiveness of non-lethal measures to minimize carnivore-livestock conflict. Topics that have been investigated, data compiled and analyzed, and research published in peer-reviewed literature include: Fladry and Turbo Fladry, Guard Animals, Scare Devices, Drones, and Human Presence and Range Riding. This body of research will be briefly covered during the presentation, along with examples of where these techniques have been successful in Colorado. This memo includes a list of the Foundational Scientific Research on these methods. Dr. Stewart Breck, Research Wildlife Biologist for the USDA-APHIS: Wildlife Services at the National Wildlife Research Center, assembled this list of publications at our request. Dr. Breck is an accomplished and respected scientist in these methods and also served on the Technical Working Group for the formation of the Colorado Wolf Restoration and Management Plan.

Both of these topics are directly related to requests in the petition received, but staff will also be presenting a general update and the meaningful progress that has been made on the other items identified in the petition on January 8th.

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Wolf Conflict Site Assessment

Proactive- ☐ Reactive- ☐

MATERIALS WAIVER *-required if livestock owner waives recommended tools and techniques*

☐ *I waive delivery of conflict minimization tools-(Initial)*

☐ *I will implement conflict minimization tools/techniques- (Initial)*

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Conflict Minimization Materials/Techniques

Viable option	Recommended by (CPW- ☐ CDA- ☐ WS- ☐)
Fladry	☐
Scare devices	☐
Electric netting	☐
Carcass management	☐
Livestock Guardian dogs	☐
Range Riding	☐
High-risk Landscape management	☐
Management Intensive Grazing	☐
Herd Composition	☐
Injurious NL Hazing (permit)	☐

Layout -Required

Calving- ☐ **Corrals-** ☐ **Summer Range-** ☐

# of linear feet- perimeter ☐

# of gates needed ☐

Notes- *Water crossings, public use trails, wildlife issues, public access, tools/techniques already implemented.*

Core Area to Secure (calving/lambing)- Sketch out or attach map of perimeter of project area. Note the placement of gates, corners, water crossings, existing fences, and terrain

CONTACT PERSON- NAME_____ **PHONE**_____

SIGNATURE_____ **EMAIL**_____

AGENCY CONTACT _____ **PHONE**_____

SIGNATURE_____ **EMAIL**_____

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Site Assessment Form – Page 2

1. Have you had past wolf depredations, and if so when (how long ago, what time of year what was depredated)?
    a. No depredation ever /Localized wolf presence/past depredations/past depredation within year and localized wolf activity

2. Are you currently implementing conflict minimization tools or techniques listed in the resource guide (which ones)?
    a. Attractant present/No/Yes/low effort tools/high effort tools

3. Have you implemented any tools/techniques not listed in the resource guide?
    a. Yes or no, and what; Low effort tools/ High effort tools/_____

4. Have you had wolf depredations (dep.) while implementing tools or techniques in the past?
    a. Depredation but no efforts/Dep with low effort/ Dep with high effort/Dep with high effort and wolf localization

5. What do you do with your dead loss?
    a. Open pit in pasture/pit separate from livestock/bury/secure/remove/

6. What time/s of year are you most concerned about?
    a. Year round/range/pair out/calving

7. To the nearest 50 animals, roughly how many livestock are we trying to protect?
    a. Predicted direct loss <.25%(1000+)/(.26%-2%(500+))/(2%-7%100+))/(7%(<100))

8. What degree of involvement are you comfortable with?
    a. Does not secure attractants/adds attractants/willing to implement low effort tools/allows staff to conduct appropriate effort in timely fashion/willing to collaborate with staff to implement appropriate effort/willing to collaborate with anyone to implement appropriate effort

9. Is there confirmed wolf activity?
    a. No/low/regular/high

10. Has the producer been properly trained on loaned equipment/techniques?
    a. Yes/No

11. Are environmental factors conducive to successful deployment of requested tools/techniques?
    a. Ground conditions; grass, sandy, gravel, dry, etc…seek consultation
    b. Unfavorable conditions/low/medium/medium high/high

12. If loaned to this producer before, what condition have we received equipment back in?
    a. Not loaned/Excellent/good/fair/poor/damaged

13. Fladry- is someone going to be able to correctly maintain it at minimum 1 time each week?
    a. Yes/No (producer or agency)

14. How likely is damage to recur?
    a. Not Likely= No Known Presence; Low=Infrequent presence, Infrequent Travel Route, Recommended Deterrents deployed; Medium= Known Travel Route, Pack Territory; High=Den/Rendezvous site, Unsecured Dead Pit

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List of Scientific Research on Non-Lethal Co-existence Methods

Fladry and Turbo Fladry - Foundational Research

Bruns, A., M. Waltert, and I. Khorozyan. 2020. The effectiveness of livestock protection measures against wolves (*Canis lupus*) and implications for their co-existence with humans. Global Ecology and Conservation 21.

Iliopoulos, Y., C. Astaras, Y. Lazarou, M. Petridou, S. Kazantzidis, and M. Waltert. 2019. Tools for co-existence: fladry corrals efficiently repel wild wolves (*Canis lupus*) from experimental baiting sites. Wildlife Research 46:484-498.

Lance, N. J., S. W. Breck, C. Sime, P. Callahan, and J. A. Shivik. 2010. Biological, technical, and social aspects of applying electrified fladry for livestock protection from wolves (*Canis lupus*). Wildlife Research 37:708-714.

Musiani, M., and E. Visalberghi. 2001. Effectiveness of fladry on wolves in captivity. Wildlife Society Bulletin 29:91-98.

Musiani, M., C. Mamo, L. Boitani, C. Callaghan, C. C. Gates, L. Mattei, E. Visalberghi, S. Breck, and G. Volpi. 2003. Wolf depredation trends and the use of fladry barriers to protect livestock in western North America. Conservation Biology 17:1538-1547.

Shivik, J. A. 2006. Tools for the edge: What's new for conserving carnivores. Bioscience 56:253-259.

Windell, R. M., L. L. Bailey, J. K. Young, T. M. Livieri, D. A. Eads, and S. W. Breck. 2022. Improving evaluation of nonlethal tools for carnivore management and conservation: evaluating fladry to protect an endangered species from a generalist mesocarnivore. Animal Conservation 25:125-136.

Young, J. K., E. Miller, and A. Essex. 2015. Evaluating Fladry Designs to Improve Utility as a Nonlethal Management Tool to Reduce Livestock Depredation. Wildlife Society Bulletin 39:429-433.

Young, J. K., J. Draper, and S. Breck. 2019. Mind the gap: Experimental tests to improve efficacy of fladry for nonlethal management of coyotes. Wildlife Society Bulletin 43:265-271.

Guard Animals - Foundational Research

Allen, L. R., N. Stewart-Moore, D. Byrne, and B. L. Allen. 2017. Guardian dogs protect sheep by guarding sheep, not by establishing territories and excluding predators. Animal Production Science 57:1118-1127.

Andelt, W. F. 1992. EFFECTIVENESS OF LIVESTOCK GUARDING DOGS FOR REDUCING PREDATION ON DOMESTIC SHEEP. Wildlife Society Bulletin 20:55-62.

Andelt, W. F., and S. N. Hopper. 2000. Livestock guard dogs reduce predation on domestic sheep in Colorado. Journal of Range Management 53:259-267.

Gehring, T. M., K. C. VerCauteren, and J. M. Landry. 2010. Livestock Protection Dogs in the 21st Century: Is an Ancient Tool Relevant to Modern Conservation

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Challenges? Bioscience 60:299-308.
Gehring, T. M., K. C. VerCauteren, M. L. Provost, and A. C. Cellar. 2010. Utility of livestock-protection dogs for deterring wildlife from cattle farms. Wildlife Research 37:715-721.
Green, J. S., and R. A. Woodruff. 1983. THE USE OF 3 BREEDS OF DOG TO PROTECT RANGELAND SHEEP FROM PREDATORS. Applied Animal Ethology 11:141-161.
Ivascu, C. M., and A. Biro. 2020. Coexistence through the Ages: The Role of Native Livestock Guardian Dogs and Traditional Ecological Knowledge as Key Resources in Conflict Mitigation between Pastoralists and Large Carnivores in the Romanian Carpathians. Journal of Ethnobiology 40:465-482.
Kinka, D., and J. K. Young. 2018. A Livestock Guardian Dog by Any Other Name: Similar Response to Wolves Across Livestock Guardian Dog Breeds. Rangeland Ecology & Management 71:509-517.
Kinka, D., and J. K. Young. 2019. Evaluating Domestic Sheep Survival with Different Breeds of Livestock Guardian Dogs. Rangeland Ecology & Management 72:923-932.
Kinka, D., J. T. Schultz, and J. K. Young. 2021. Wildlife responses to livestock guard dogs and domestic sheep on open range. Global Ecology and Conservation 31.
Lieb, Z., B. Tumurbaatar, B. Elfström, and J. Bull. 2021. Impact of livestock guardian dogs on livestock predation in rural Mongolia. Conservation Science and Practice 3.
Linhart, S. B., R. T. Sterner, T. C. Carrigan, and D. R. Henne. 1979. KOMONDOR GUARD DOGS REDUCE SHEEP LOSSES TO COYOTES - PRELIMINARY EVALUATION. Journal of Range Management 32:238-241.
Mosley, J. C., B. L. Roeder, R. A. Frost, S. L. Wells, L. B. McNew, and P. E. Clark. 2020. Mitigating Human Conflicts with Livestock Guardian Dogs in Extensive Sheep Grazing Systems. Rangeland Ecology & Management 73:724-732.
Scasta, J. D., B. Stam, and J. L. Windh. 2017. Rancher-reported efficacy of lethal and non-lethal livestock predation mitigation strategies for a suite of carnivores. Scientific Reports 7.
Smith, M. E., J. D. C. Linnell, J. Odden, and J. E. Swenson. 2000. Review of methods to reduce livestock depredation: I. Guardian animals. Acta Agriculturae Scandinavica Section a-Animal Science 50:279-290.
Spencer, K., M. Sambrook, S. Bremner-Harrison, D. Cilliers, R. W. Yarnell, R. Brummer, and K. Whitehouse-Tedd. 2020. Livestock guarding dogs enable human-carnivore coexistence: First evidence of equivalent carnivore occupancy on guarded and unguarded farms. Biological Conservation 241.
VerCauteren, K., M. Lavelle, T. M. Gehring, J. M. Landry, and L. Marker. 2014. Dogs as mediators of conservation conflicts.
Volski, L., A. McInturff, K. M. Gaynor, V. Yovovich, and J. S. Brashares. 2021. Social Effectiveness and Human-Wildlife Conflict: Linking the Ecological Effectiveness and Social Acceptability of Livestock Protection Tools. Frontiers in Conservation Science 2.

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Scare Devices - Foundational Research

Bomford, M., and P. H. Obrien. 1990. SONIC DETERRENTS IN ANIMAL DAMAGE CONTROL - A REVIEW OF DEVICE TESTS AND EFFECTIVENESS. Wildlife Society Bulletin 18:411-422.

Bott C.A., S.W. Breck, J.K. Young. 2024. Livestock Flashtags: Evaluating a novel deterrent to reduce livestock depredation. Human-Wildlife Interactions (IN PRESS).

Breck, S. W., R. Williamson, C. Niemeyer, and J. A. Shivik. 2002. Non-lethal radio activated guard for deterring wolf depredation in Idaho: Summary and call for research. Pages 223-226 *in* 20th Vertebrate Pest Conference, Reno, Nv.

Bruns, A., M. Waltert, and I. Khorozyan. 2020. The effectiveness of livestock protection measures against wolves (*Canis lupus*) and implications for their co-existence with humans. Global Ecology and Conservation 21.

Eklund, A., J. Vicente Lopez-Bao, M. Tourani, G. Chapron, and J. Frank. 2017. Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores. Scientific Reports 7.

Hall, K. J., and P. A. Fleming. 2021. In the spotlight: Can lights be used to mitigate fox predation on a free-range piggery? Applied Animal Behaviour Science 242.

Khorozyan, I., and M. Waltert. 2019. How long do anti-predator interventions remain effective? Patterns, thresholds and uncertainty. Royal Society Open Science 6.

Linhart, S. B., R. T. Sterner, G. J. Dasch, and J. W. Theade. 1984. EFFICACY OF LIGHT AND SOUND STIMULI FOR REDUCING COYOTE PREDATION UPON PASTURED SHEEP. Protection Ecology 6:75-84.

Linhart, S. B., G. J. Dasch, R. R. Johnson, J. D. Roberts, and C. J. Packham. 1992. ELECTRONIC FRIGHTENING DEVICES FOR REDUCING COYOTE PREDATION ON DOMESTIC SHEEP - EFFICACY UNDER RANGE CONDITIONS AND OPERATIONAL USE. Pages 386-392 *in* 15th Vertebrate Pest Conf, Newport Beach, Ca.

Linhart, S. B., G. J. Dasch, R. R. Johnson, J. D. Roberts, and C. J. Packham. 1992. Electronic frightening devices for reducing coyote predation on domestic sheep: efficacy under range conditions and operational use. Proceedings of the Vertebrate Pest Conference 15:386-392.

Lorand, C., A. Robert, A. Gastineau, J.-B. Mihoub, and C. Bessa-Gomes. 2022. Effectiveness of interventions for managing human-large carnivore conflicts worldwide: Scare them off, don't remove them. Science of the Total Environment 838.

Ohrens, O., C. Bonacic, and A. Treves. 2019. Non-lethal defense of livestock against predators: flashing lights deter puma attacks in Chile. Frontiers in Ecology and the Environment 17:32-38.

Shivik, J. A., A. Treves, and P. Callahan. 2003. Nonlethal techniques for managing predation: Primary and secondary repellents. Conservation Biology 17:1531-1537.

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Smith, M. E., J. D. C. Linnell, J. Odden, and J. E. Swenson. 2000. Review of methods to reduce livestock depredation II. Aversive conditioning, deterrents and repellents. Acta Agriculturae Scandinavica Section a-Animal Science 50:304-315.

Smith, B. P., N. B. Jaques, R. G. Appleby, S. Morris, and N. R. Jordan. 2021. Automated shepherds: responses of captive dingoes to sound and an inflatable, moving effigy. Pacific Conservation Biology 27:195-201.

Drones – Foundational Research

Ranglack, D. H., L. M. McCurdy, P. C. Wolf, and L. Miller. 2024. Drones as a potential hazing tool to prevent wolf depredations on livestock. Global Ecology and Conservation 56.

Human Presence and Range Riding - Foundational Research

Louchouarn, N. X., and A. Treves. 2023. Low-stress livestock handling protects cattle in a five-predator habitat. Peerj 11.

Stone, S. A., S. W. Breck, J. Timberlake, P. M. Haswell, F. Najera, B. S. Bean, and D. J. Thornhill. 2017. Adaptive use of nonlethal strategies for minimizing wolf-sheep conflict in Idaho. Journal of Mammalogy 98:33-44.

Versluijs, E., A. Eriksen, B. Fuchs, C. Wikenros, H. Sand, P. Wabakken, and B. Zimmermann. 2022. Wolf Responses to Experimental Human Approaches Using High-Resolution Positioning Data. Frontiers in Ecology and Evolution 10.

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