MEMO
DATE: 8 November 2019
TO: Dr. Pierre Taberlet, chair of the CS Loup
FROM: Dr. Adrian Treves, Professor, Nelson Institute for Environmental Studies, University of
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SUBJECT: Interpretation of evidence for protecting livestock from wolf attacks

10 line summary requested by Dr. Taberlet
Any method for protecting livestock should first be proven effective before investment and promotion
to the public. I cannot recommend anything without strong , scientific evidence of its effectiveness – as
a priority and absolute first necessity. Just policy should also consider if livestock should be allowed in
every place. I consider worldwide evidence, but only if based on reproducible, transparent, and reliable
science. From the French Alps, I find only 1 study of livestock protection to be persuasive: livestock-
guarding dogs and night-time enclosures seemed effective. Short of eradication, the science of killing
predators is clear that non-selective methods that are not focused on sites, times, or individual
predators implicated in livestock losses have a very poor record of effectiveness. Even selective killing of
predators has a mixed record, including much evidence of counter-productive increases in livestock
losses, from 8 independent scientific reviews in international scientific journals. The general reviews are
in agreement that non-lethal methods have a better record of success with stronger evidence.

I interpret a scientific council to mean that it weighs the evidence from scientific studies to make a
recommendation to the government. Pending completion of the study of protective methods now in
place and its analysis, and pending the completion of the ONCSF thesis on wolf-killing (assuming these
are done properly), I do not know much scientific about the effectiveness of the methods in place nor
can I recommend a change or continuation of any method.

Regarding scientific evidence from France, I find Espuno's 2004 study in the French Alps (1) instructive
should one wish to justify recommending continuation of livestock-guarding dogs and night-time
enclosures. With or without French evidence, we should be considering the worldwide evidence if based
on reproducible, transparent, and reliable science. I have summarized it below from 7 general reviews in
the last 3 years (2-8) and one specific to U.S. wolf-killing (9).
A. Centuries of experience suggest that eradicating predators reduces livestock loss. However, this
    is clearly not legal.
B. Short of eradication, the science of killing predators is clear that non-selective methods that are
    not focused on sites, times, or individual predators implicated in livestock losses have a very
    poor record of reducing livestock loss. In Europe, the mixed evidence for non-selective lethal
    methods is a minimal effect with lynx (10), counter-productive for wolves (11), or ineffective for
    wolves and brown bears respectively (12,13). All these studies are weakened by a lack of
    experimental control over the methods used so we do not know which method or instance of
    killing was effective., if any
C. Selective killing targeted to remove suspected culprits near the place and time of livestock loss
    has a mixed record from independent reviews (2-9) and some studies find counter-productive
    effects of such lethal control leading to more livestock losses. For example, the study by
    Santiago-Ávila et al. 2018 (9) uses the same method as the ongoing ONCFS thesis evaluating
    wolf-killing in France. Therefore, I elaborate on (9). Santiago-Ávila et al. (9) helps to explain why
    there is so little evidence for the effectiveness of lethal methods (most governments do not
    measure whether it protects livestock beyond the site or up to a year after wolf-killing). More
    importantly, this study uses spatial analysis at farms and their neighbors to help explain why

even selective methods for killing suspected culprit wolves may backfire and lead to more livestock losses. They coined the term spill-over effects for killing wolves on one farm and creating problems on neighboring farms – and the risk for neighbors was three times higher than the lower risk for the original farm. Furthermore, (9) proposes a hypothesis for human perception of lethal control that France could be the first nation to test scientifically. That study proposed that farmers who see a wolf killed by the government perceive a benefit (even if it is slight or non-existent in terms of future safety for livestock) and report that to neighbors who may be experiencing the spill-over effects. Those neighbors may then demand lethal control also. Therefore, the long-term result might be 'contagion' of demands for wolf-killing that simply spread the harm to livestock herds that would otherwise have been safe. Santiago-Ávila et al. (9) discusses the analysis of before-and-after comparisons of interventions, as used by the thesis supported by ONCFS. I am happy to advise on the analytical methods.

D. The general reviews (2-8) are in agreement that non-lethal methods have a better record of success with stronger evidence.

E. Any method of protecting livestock whether non-lethal or lethal should first be proven effective before investment and promotion to the public and to farmers. I cannot recommend anything without strong evidence of its effectiveness – as a priority and absolute first necessity – otherwise I do a disservice to the public including farmers who want reliable evidence to protect livestock. Fair and just policy should also consider if livestock should be allowed in all places.

Reviews

1. Espuno, Lequette, Poulle, Migot, Lebreton 2004. Heterogeneous response to preventive sheep husbandry during wolf recolonization of the French Alps. Wildlife Society Bulletin 32, 1195-1208
2. Eklund, A., López-Bao, J.V., Tourani, M., Chapron, G., Frank, J., 2017. Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores. Scientific Reports 7, 2097 | DOI:2010.1038/s41598-41017-02323-w.
3. Khorozyan, I., Waltert, M., 2019. How long do anti-predator interventions remain effective? Patterns, thresholds and uncertainty. Royal Society Open Science 6.
4. Miller, J., Stoner, K., Cejtin, M., Meyer, T., Middleton, A., Schmitz, O., 2016. Effectiveness of Contemporary Techniques for Reducing Livestock Depredations by Large Carnivores. Wildlife Society Bulletin 40, 806-815.
5. Moreira-Arce, D., Ugarte, C.S., Zorondo-Rodríguez, F., Simonetti, J.A., 2018. Management Tools to Reduce Carnivore-Livestock Conflicts: Current Gap and Future Challenges. Rangeland Ecology & Management.
6. Treves, A., Krofel, M., McManus, J., 2016. Predator control should not be a shot in the dark. Frontiers in Ecology and the Environment 14, 380-388.
7. van Eeden, L.M., Crowther, M.S., Dickman, C.R., Macdonald, D.W., Ripple, W.J., Ritchie, E.G., Newsome, T.M., 2018. Managing conflict between large carnivores and livestock. Conservation Biology doi: 10.1111/cobi.12959.
8. van Eeden, L.M., Ann Eklund, Jennifer R. B. Miller, José Vicente López-Bao, Mikael R. Cejtin, Guillaume Chapron, Mathew S. Crowther, Christopher R. Dickman, Jens Frank, Miha Krofel, David W. Macdonald, Jeannine McManus, Tara K. Meyer, Arthur D. Middleton, Thomas M. Newsome, William J. Ripple, Euan G. Ritchie, Oswald J. Schmitz, Kelly J. Stoner, Mahdieh Tourani, Treves, A., 2018. Carnivore conservation needs evidence-based livestock protection. PLoS Biology https://doi.org/10.1371/journal.pbio.2005577,
9. Santiago-Avila, F.J., Cornman, A.M., Treves, A., 2018. Killing wolves to prevent predation on livestock may protect one farm but harm neighbors. PLos ONE 10.1371/journal.pone.0189729.

10. Herfindal, I., Linnell, J.D.C., Moa, P.F., J., O., Austmo, L.B., Andersen, R., 2005. Does recreational hunting of lynx reduce depredation losses of domestic sheep? Journal of Wildlife Management 69, 1034-1042.
11. Fernández-Gil, A., Naves, J., Ordiz, A.s., Quevedo, M., Revilla, E., Delibes, M., 2015. Conflict Misleads Large Carnivore Management and Conservation: Brown Bears and Wolves in Spain. PLos ONE DOI:10.1371/journal.pone.0151541, 1-13.
12. Krofel, M., Černe, R., Jerina, K., 2011. Effectiveness of wolf (Canis lupus) culling as a measure to reduce livestock depredations. Acta Silvae et Ligni 95, 11-22.
13. Sagør, J.T., Swenson, J.E., Roskaft, E., 1997. Compatibility of brown bear Ursus arctos and free-ranging sheep in Norway. Biological Conservation 81, 91-95.