

# Towards Aligning Conservation Wildlife Outcomes and Agriculture Production

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## Introduction

Recently, wildlife conservation author, Emma Marris, detailed numerous cases in her book *Wild Souls* (2021) about the many dilemmas and debates in the conversation field about the killing of predators. Swan et al., (2020) suggest if scientists hope to meaningfully engage farmers with alternate methods for mitigating livestock losses they need to understand farmer perspectives.

Therefore, an understanding of Pennsylvania livestock producers' mental models of livestock predation and predator control strategies are necessary before agriculture production and conservation wildlife outcomes can be aligned.

Mental models describe the way people organize and use their knowledge to make inferences about the world before acting (Johnson-Laird, 1980). When measured, mental models capture the interdependent relationships among values, beliefs, behavior, and cognitive processes of human decision making (Dietz, 2005). Agriculture researchers are beginning to use mental models to understand decision-making within agroecological systems (Jones, 2011). Comparing the mental models of livestock farmers and wildlife conservation biologists will allow us to answer our research question.

### Research Question:

*Do wildlife conservation biologists and livestock farmers differ in their perceptions of predator threats and control methods?*

## Methods

Two surveys, one for conservationists and one for farmers, were created with 17 questions each including demographics questions, open ended questions, and vignettes. Surveys received IRB approval and were distributed through several resources.

To analyze mental models, a code book was designed with potential themes and ideas. QDA Minder was used to code the open ended responses for mental models of predation and control strategies.

### Coding Categories:

- (1) Harm to livestock (e.g. injury or death)
- (2) Economic implications (e.g. loss or cost)
- (3) Type of predator (e.g. terrestrial or aerial)
- (4) Type of livestock victim (e.g. sheep or poultry)
- (5) Type of control strategy (e.g. lethal or nonlethal)
- (6) Legality of control strategy (e.g. legal or not)

Once responses were coded, co-occurrence of codes were analyzed and developed into an adjacency matrix. The adjacency matrix was exported for use in NodeXL a network software. Network maps connected concepts were built using the Harel-Koren Fast Multiscale algorithm.

Do you raise livestock or poultry?  
Take our survey. Scan QR code:



## References

- Johnson-Laird, P. (1980). *Mental Models in Cognitive Science*. Cognitive Science, 7:1-115.
- Marris, E. (2021). *Wild Souls*. New York: Bloomsbury Publishing.
- Natalie A. Jones, H. R. (2011). *Mental Models: An Interdisciplinary Synthesis of Theory and Methods*. Ecology and Society, 1:1-13.
- Swan, G. J.-R. (2020). For livestock losses, a conservation scientist's 'exceptional' may be a farmer's 'unacceptable': A commentary to Ballejo et al. (2020). *Biological Conservation*, 2.
- Thomas Dietz, A. F. (2005). *Environmental Values*. Annual Review of Environment and Resources, 40.

## Results

*Livestock predation means different things to different people. In a few sentences, what comes to mind when you think about livestock predation?*

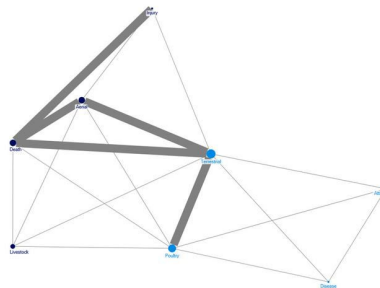


Figure 1. Farmers' Mental Model of Livestock Predation  
N = 4; Concepts = 8; Connections = 18; Density = .643

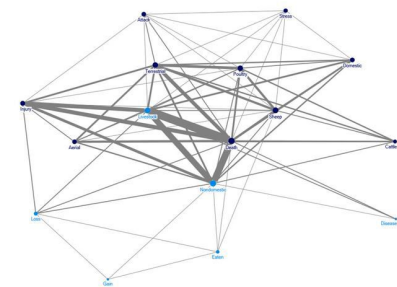


Figure 2. Wildlife Biologists' Mental Model of Livestock Predation  
N = 39; Concepts = 16; Connections = 68; Density = .567

*Based on your experience and/or understanding of livestock predation, in a few sentences please briefly discuss what strategies you think exist to address it.*

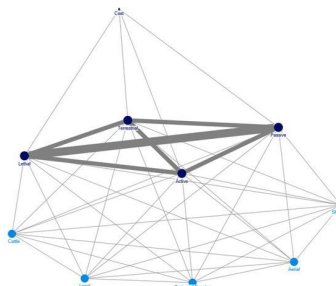


Figure 3. Farmers' Mental Model of Control Strategies  
N = 4; Concepts = 10; Connections = 40; Density = .889

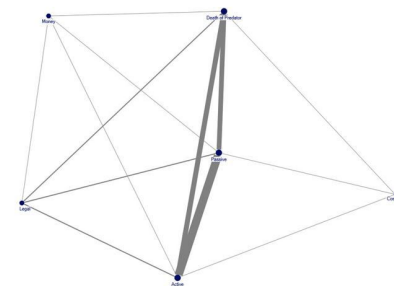


Figure 4. Wildlife Biologists' Mental Model of Control Strategies  
N=38; Concepts = 6; Connections = 13; Density = .867

## Discussion

Even though more wildlife biologists responded, the increased number of concepts and connections between concepts when thinking about livestock predation suggests that wildlife biologist have a broader understanding while farmers have a more specific, "on the ground" understanding. Farmers focused on terrestrial predators (e.g. coyotes) killing poultry, as noticed with the thicker width of the lines connecting these concepts. When thinking about livestock predation, wildlife biologists more generally thought about "wild" or nondomestic animals killing livestock. Analysis of these mental models shows that farmers may have a deeper connection to the predator-prey actions than the wildlife biologist. Again, the generalized language used by wildlife biologists suggests more distance from the actions.

Mental models of control strategies revealed two separate central concepts. We grouped nonlethal methods into two groups, passive and active. Passive methods are farm management methods like bringing livestock in at night or putting up fencing. Active is managing to directly confront would be predators, like instituting guardian animals. Neither are designed to be lethal to predators. When thinking about strategies to control predation, farmers focused on more active, non-lethal and lethal options. Active options here included using firearms to kill predators or trapping predators. Wildlife biologists, on the other hand, had a central focus on passive, non-lethal options, while still mentioning active, non-lethal and lethal options. Passive options here included keeping brush lines clear and livestock away from cover bush as this would allow predators to hide/hunt. The connections made by both populations seem to think about a multistep approach using a combination of methods, just with a different degree of starting point and potential threshold for moving to lethal options. These differences in focus of control strategy may connect back to the specificity and generalized statements on predator-prey relationships discussed above.

## Conclusion

- These mental models may reveal that farmers' are eliciting vivid predator-prey experiences of their animals. That personal connection may lead to the more active starting point with control strategies.
- Increasing the number of farmer respondents is a critical step to validate these nuanced connections.