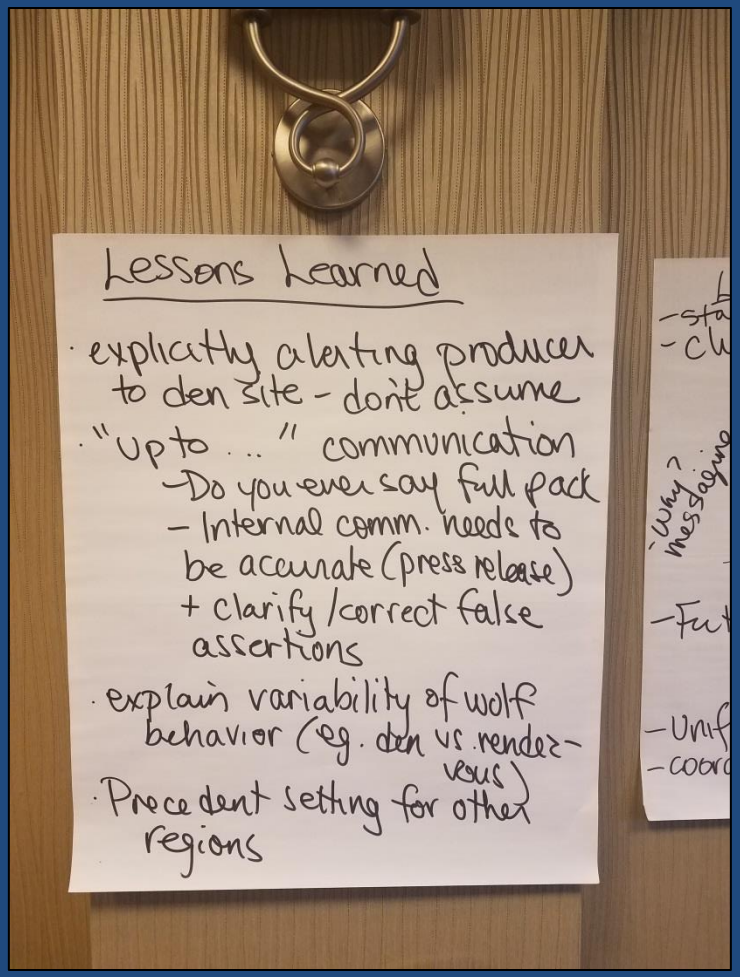
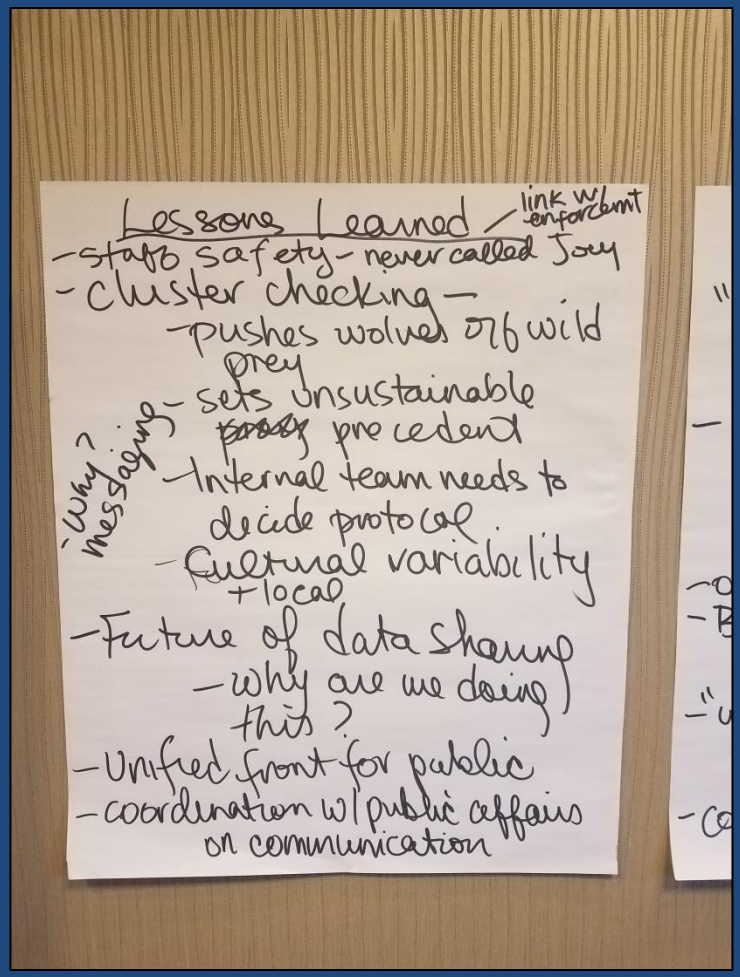
September 14-15, 2016 WAG Meeting Flipchart Notes





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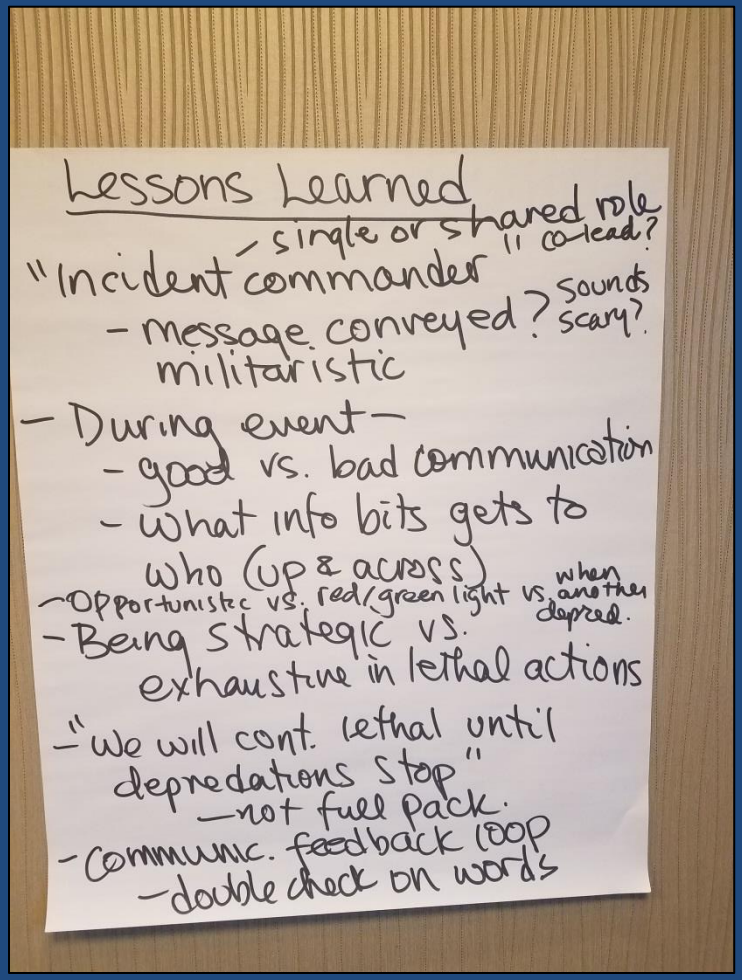

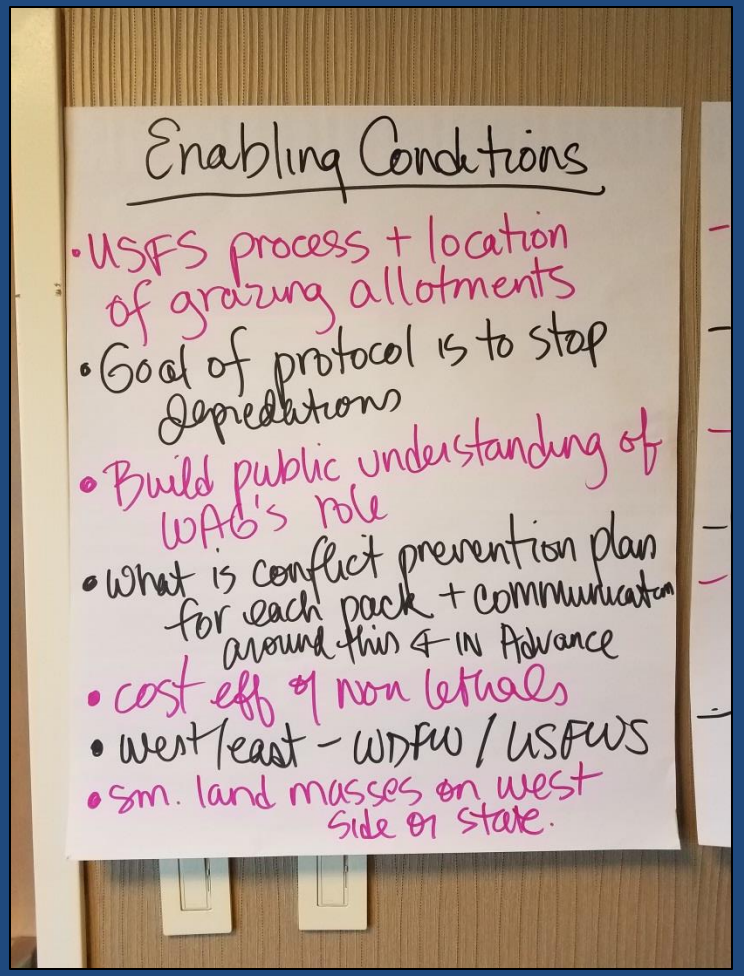

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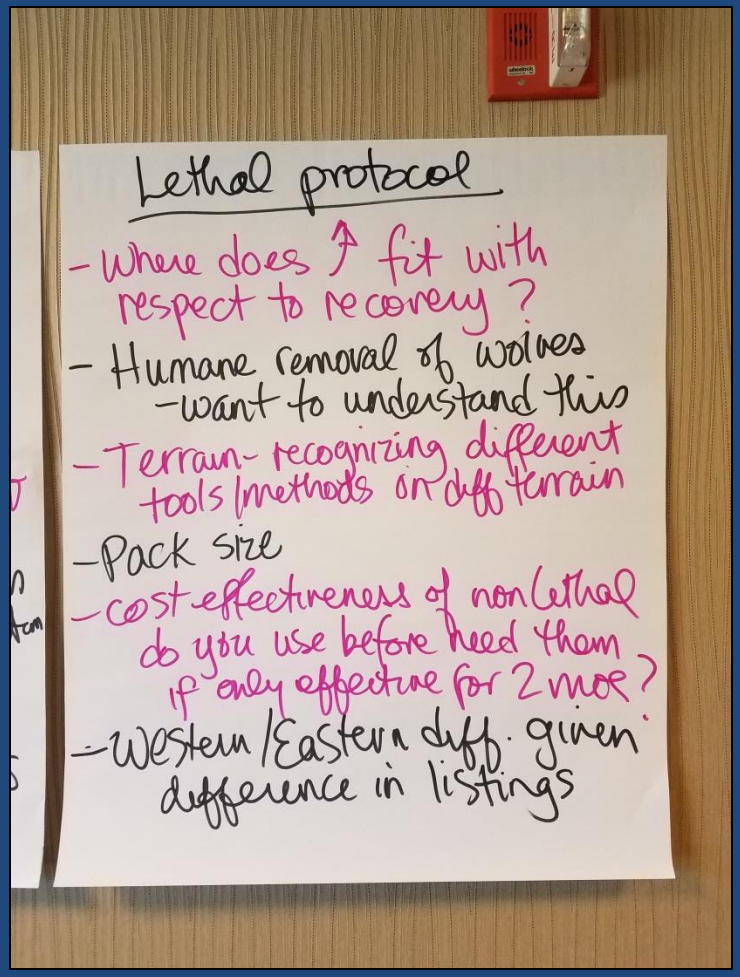

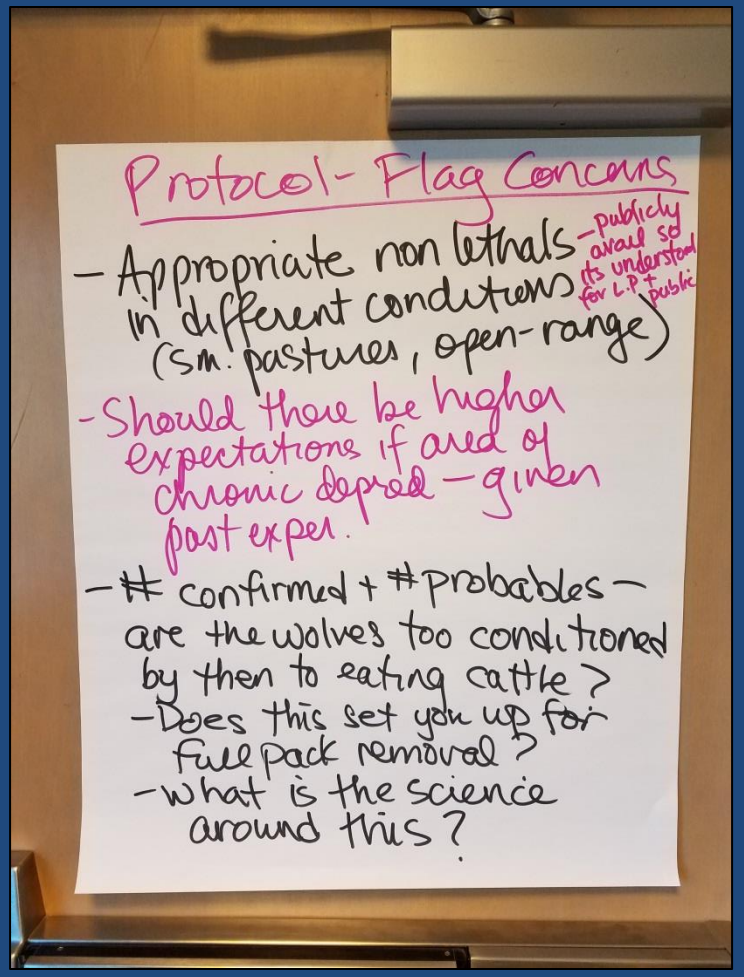

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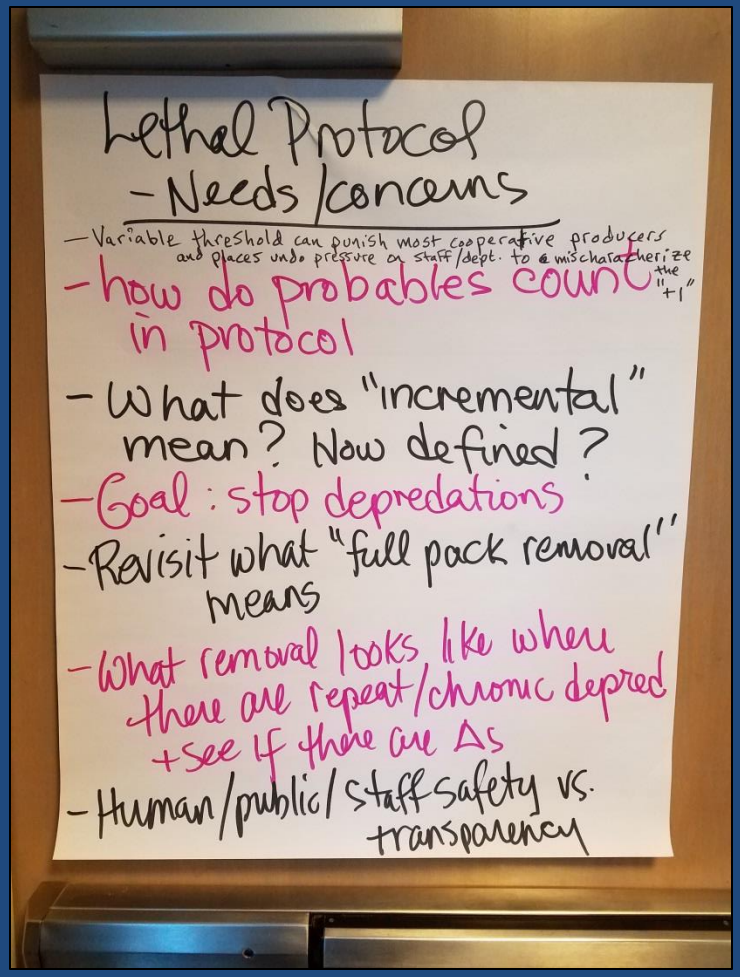

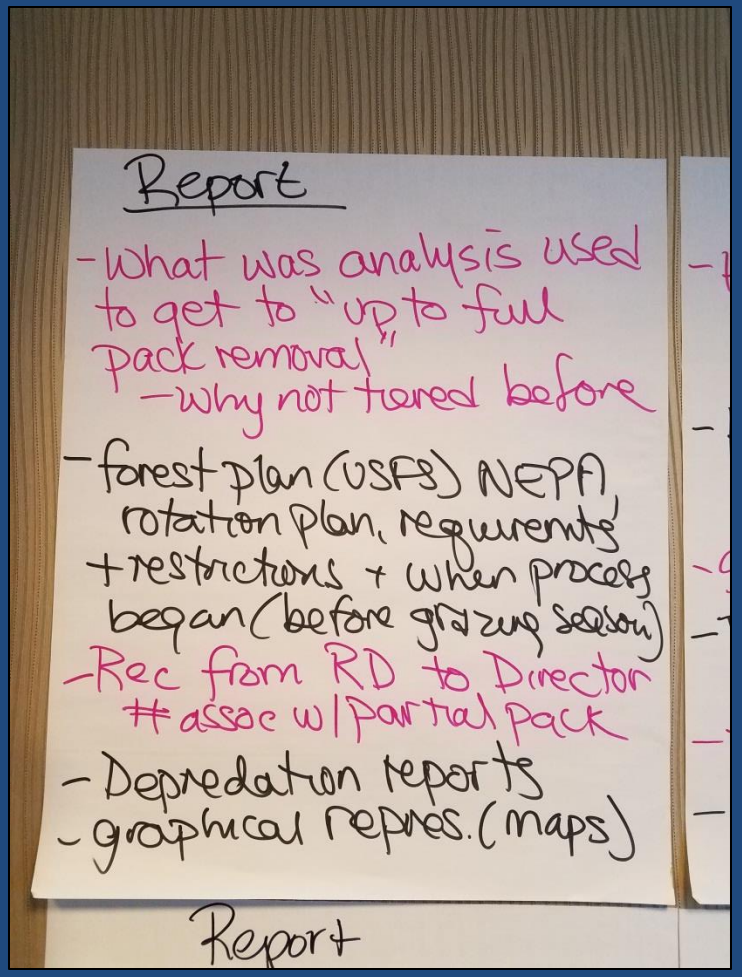

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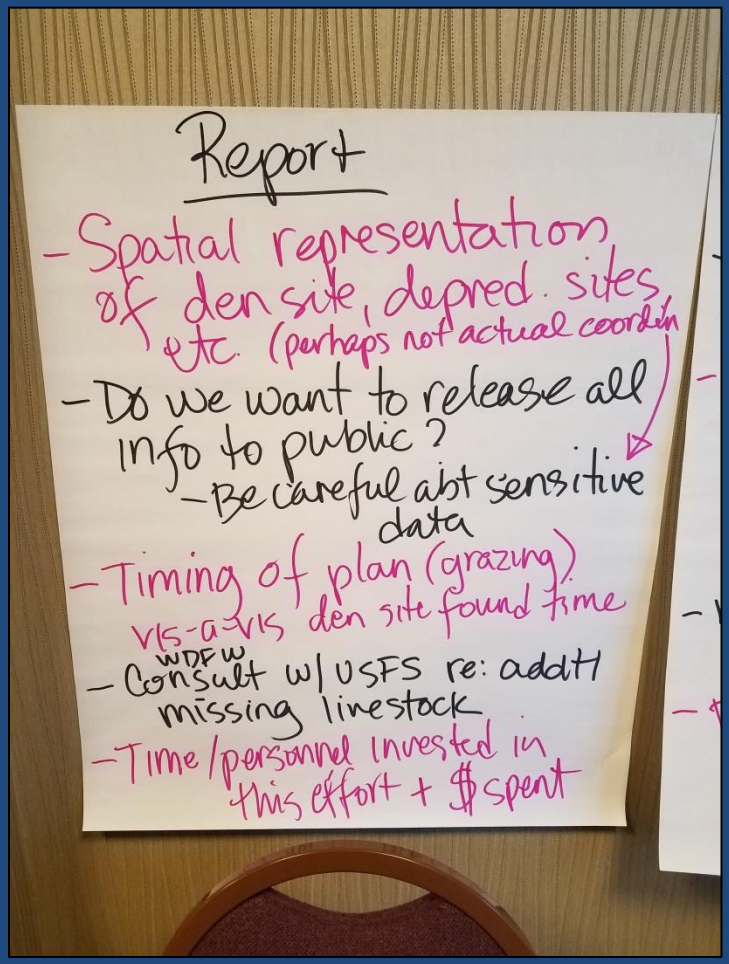

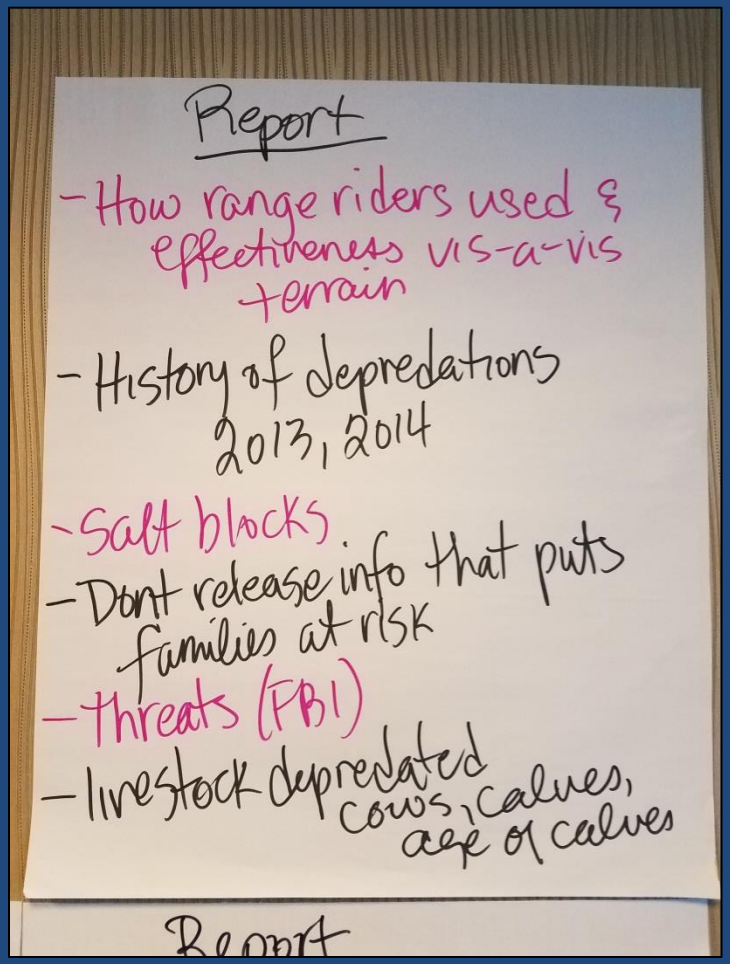

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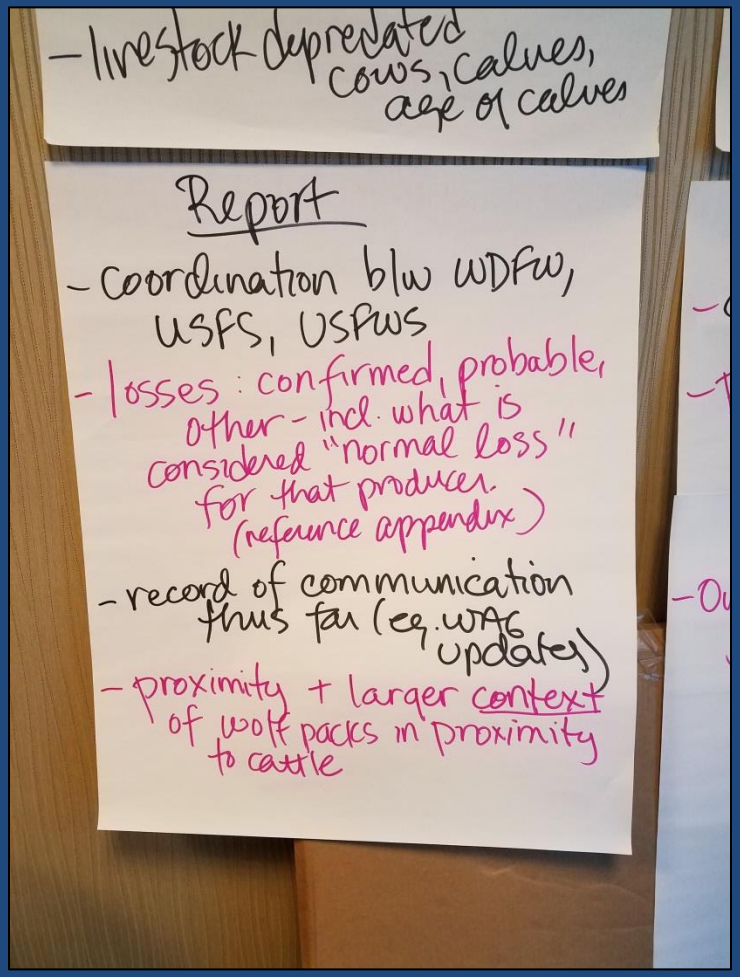

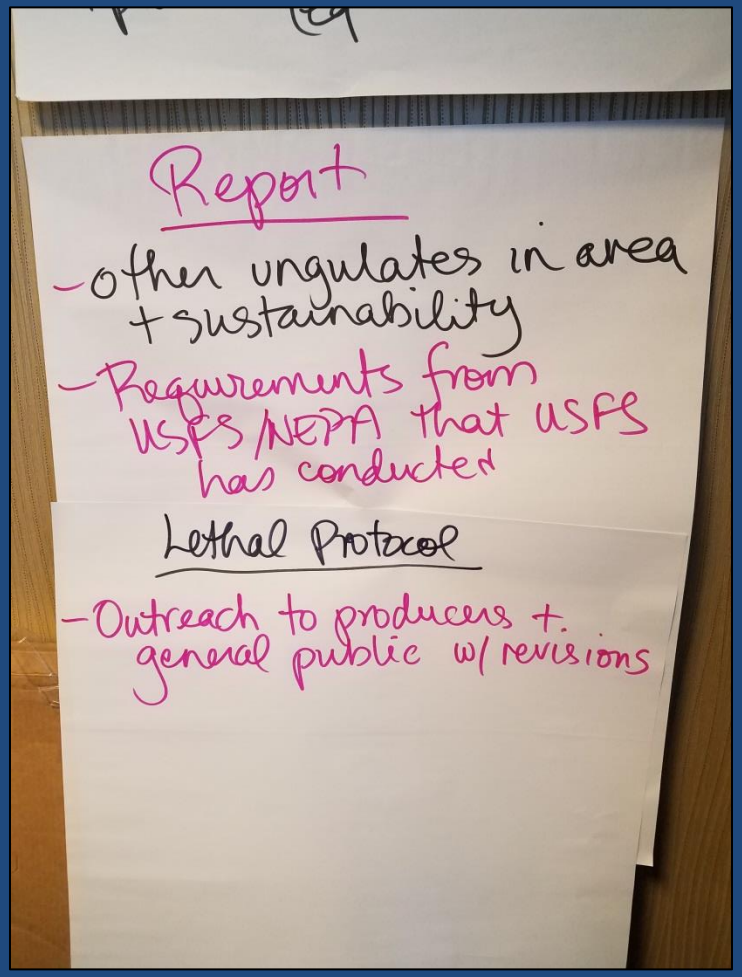

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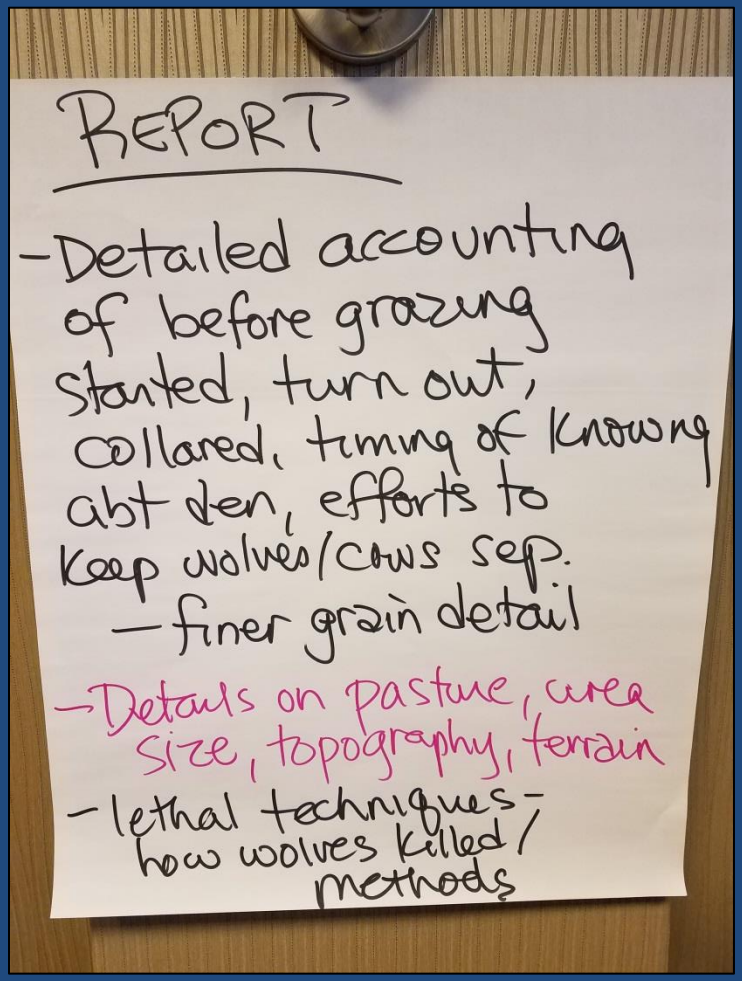

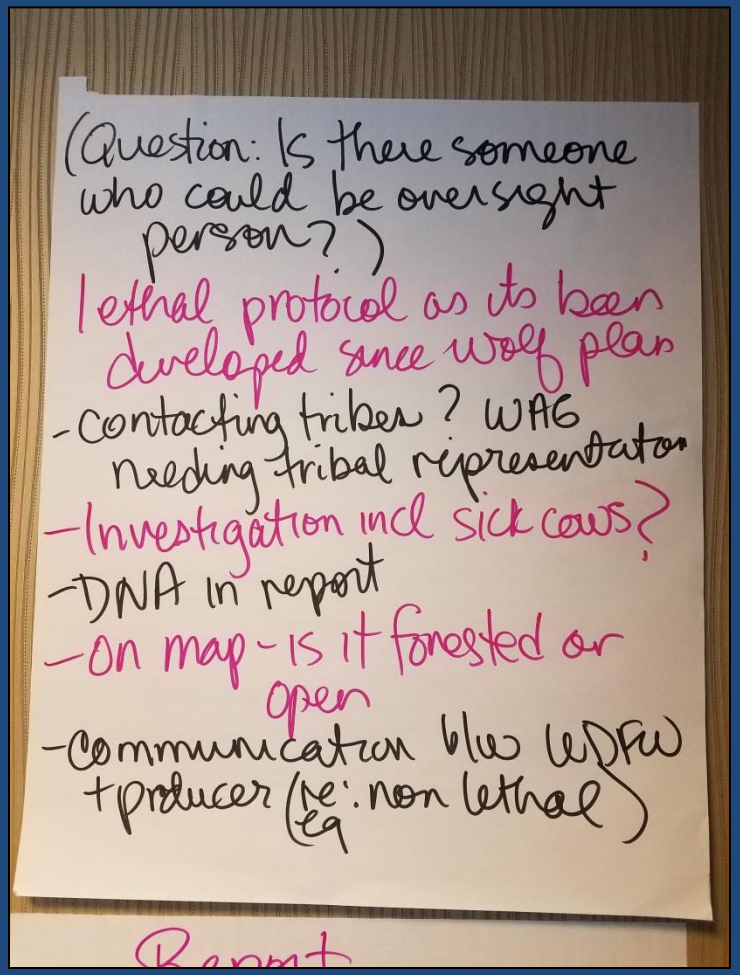

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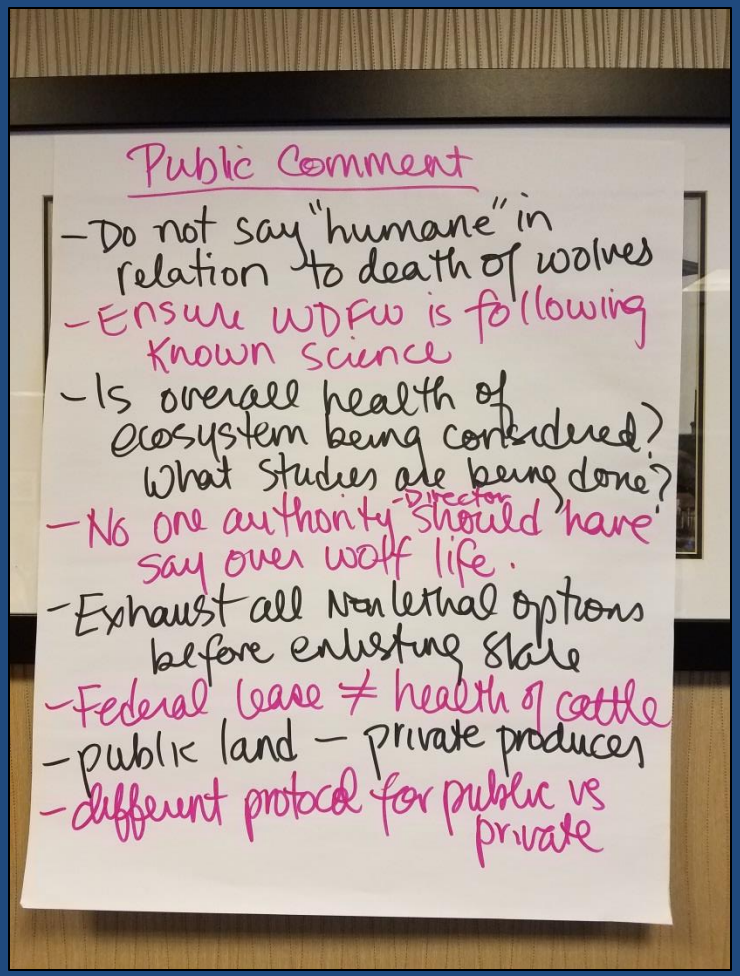

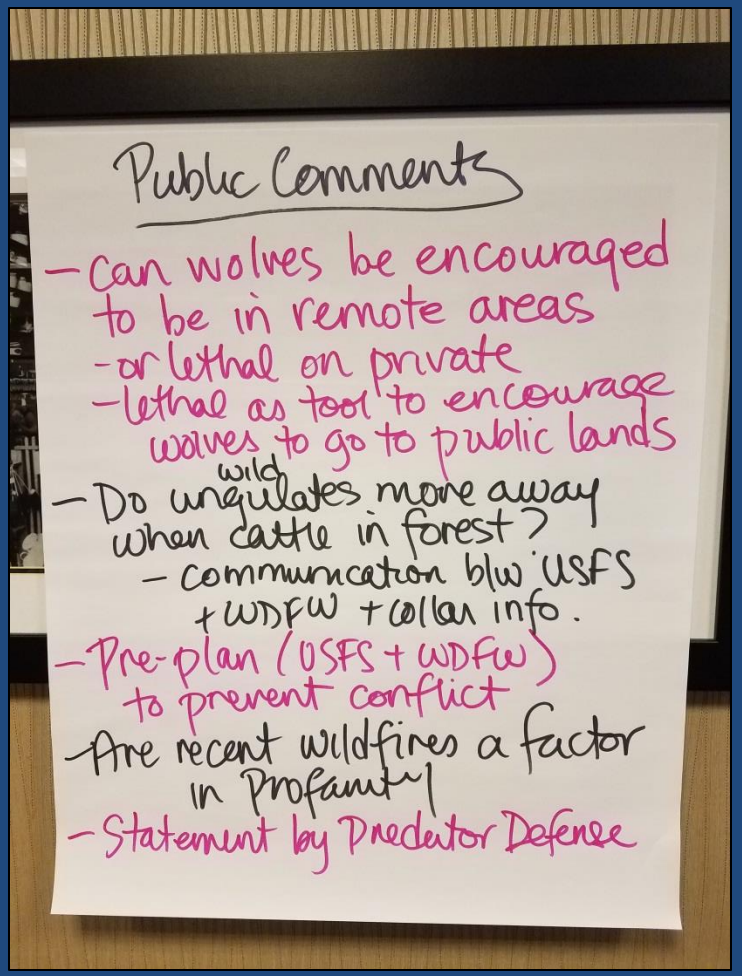

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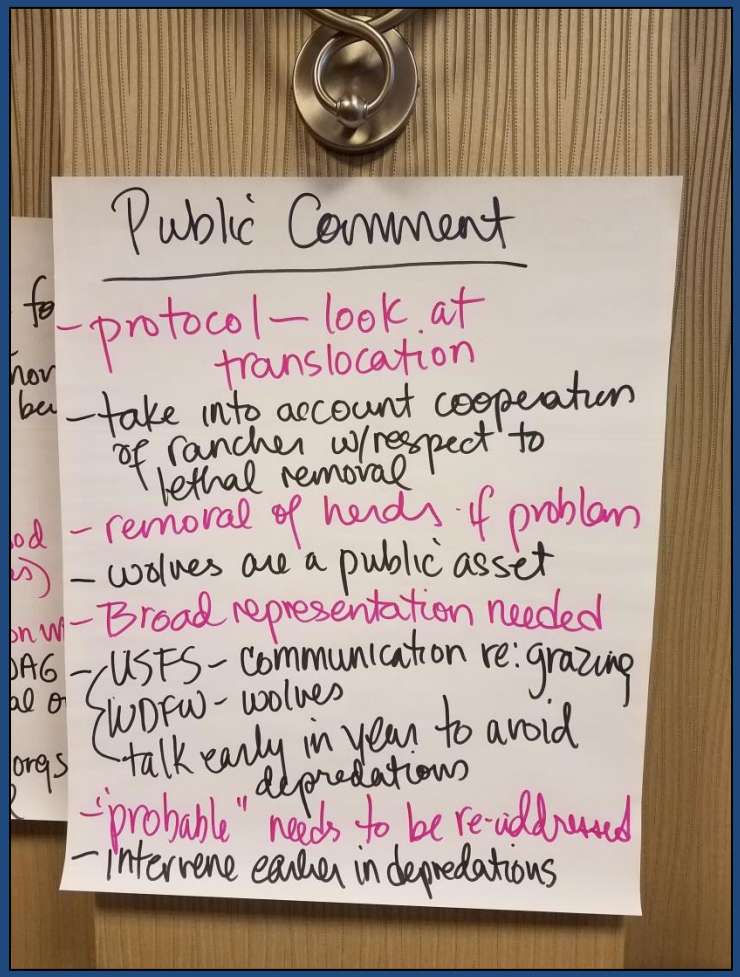

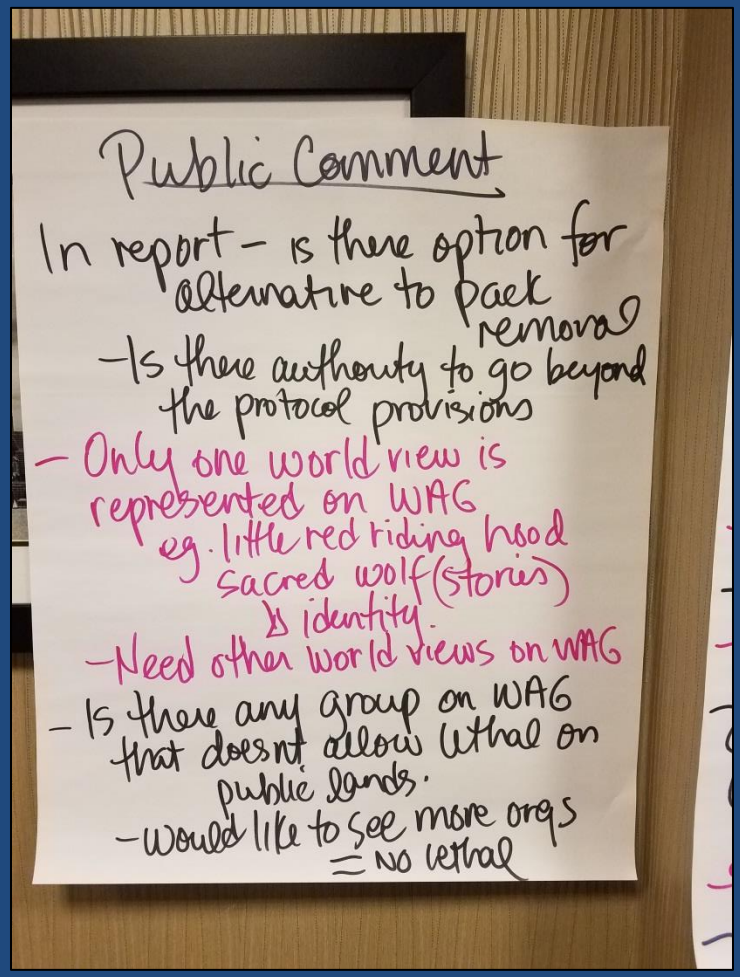

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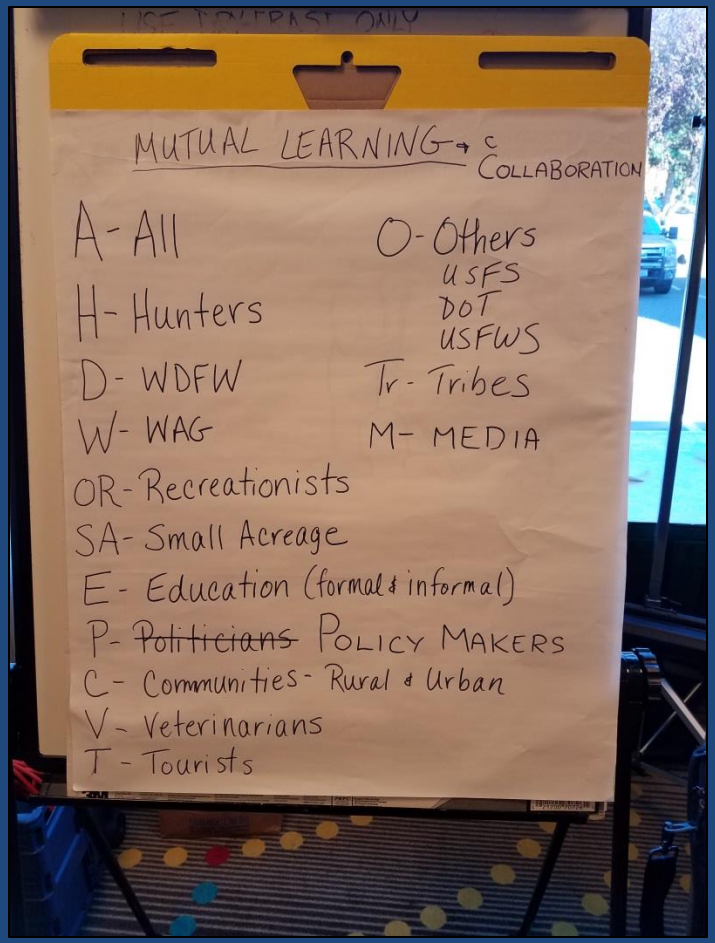

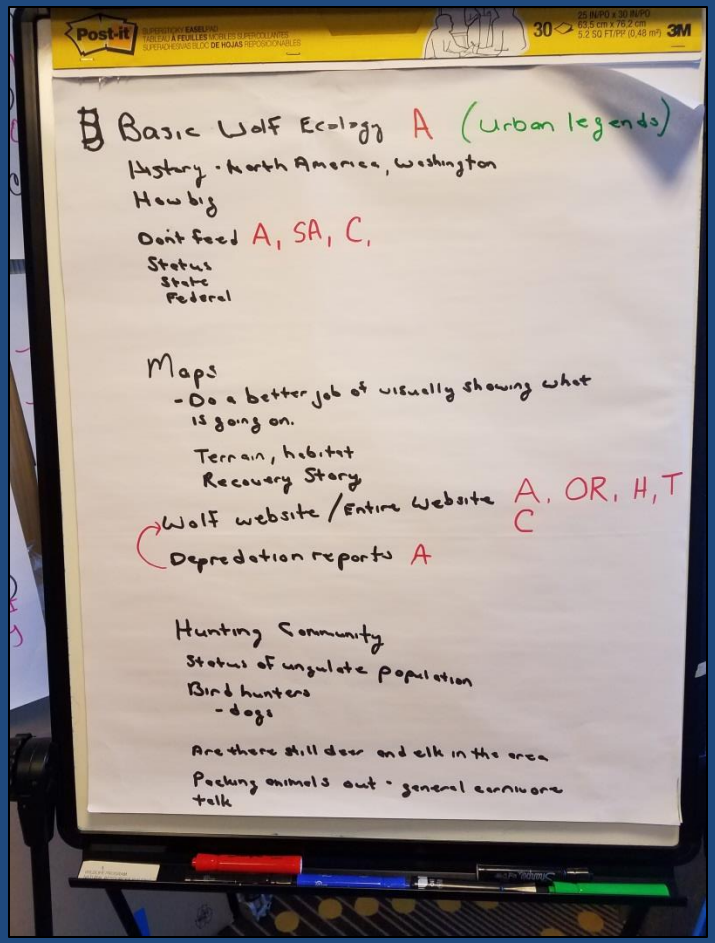

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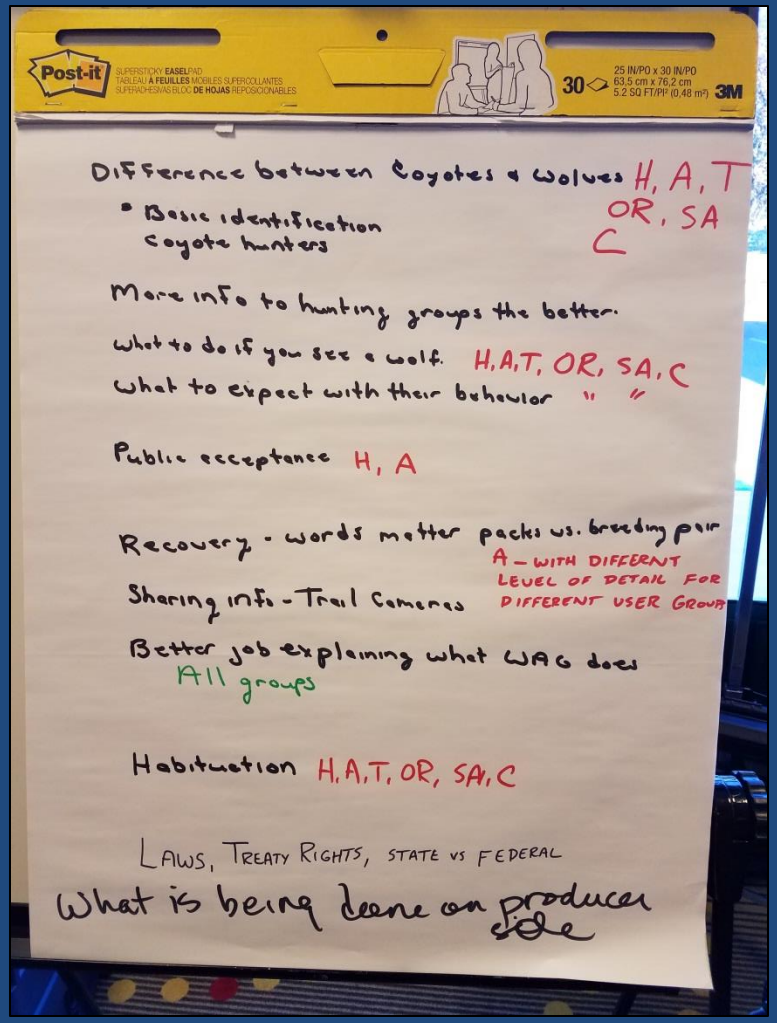
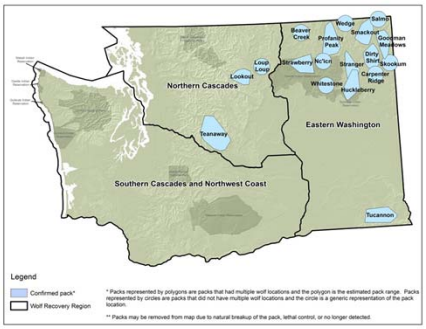
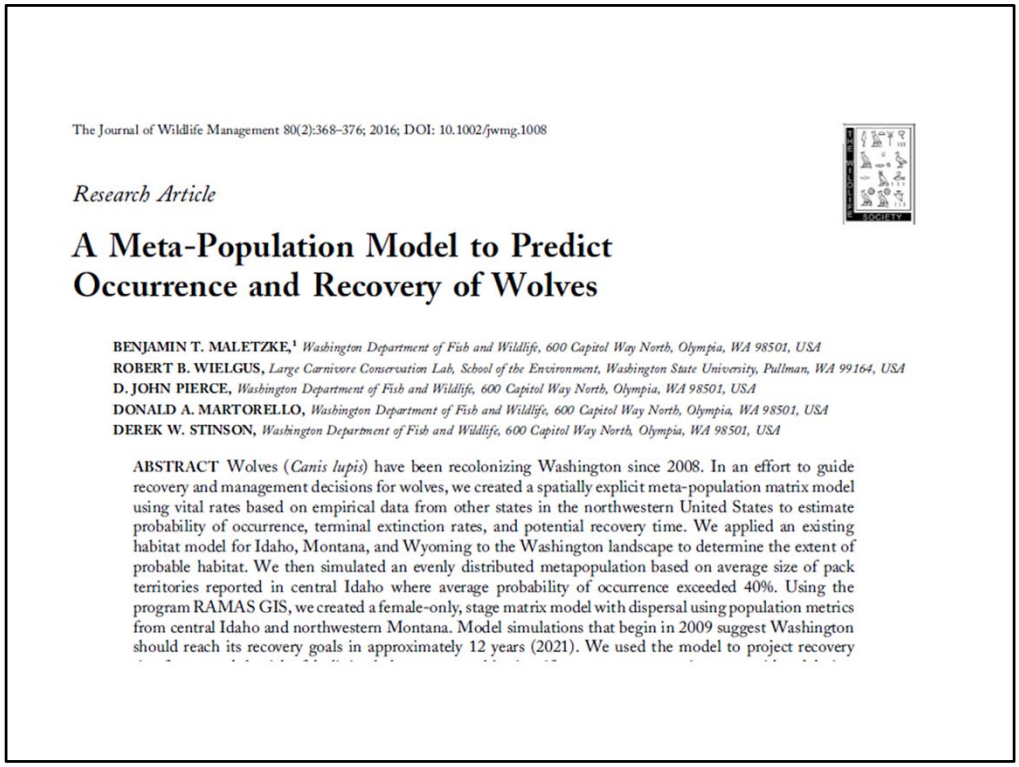


Wolf Conservation and Management Plan for Washington: Population Modeling

WAG Briefing 9/15/2016

John Pierce, WDFW Chief Wildlife Scientist





The Journal of Wildlife Management 80(2):368–376; 2016; DOI: 10.1002/jwmg.1008

Research Article

A Meta-Population Model to Predict Occurrence and Recovery of Wolves

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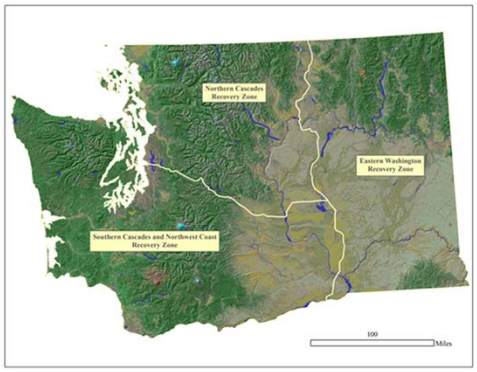
ABSTRACT Wolves (*Canis lupis*) have been recolonizing Washington since 2008. In an effort to guide recovery and management decisions for wolves, we created a spatially explicit meta-population matrix model using vital rates based on empirical data from other states in the northwestern United States to estimate probability of occurrence, terminal extinction rates, and potential recovery time. We applied an existing habitat model for Idaho, Montana, and Wyoming to the Washington landscape to determine the extent of probable habitat. We then simulated an evenly distributed metapopulation based on average size of pack territories reported in central Idaho where average probability of occurrence exceeded 40%. Using the program RAMAS GIS, we created a female-only, stage matrix model with dispersal using population metrics from central Idaho and northwestern Montana. Model simulations that begin in 2009 suggest Washington should reach its recovery goals in approximately 12 years (2021). We used the model to project recovery

The modeling results reported here are in the Wolf Conservation and Management Plan, and have been peer reviewed and published in the Journal of Wildlife Management.

Maletzke, B. T., R. B. Wielgus, D. J. Pierce, D. A. Martorello and D. W. Stinson. 2016. A Meta-Population Model to Predict Occurrence and Recovery of Wolves. J. Wild. Manage. 80(2):368-376.

SEPA Process Comments raised Questions:



- Are Population/Breeding Pair Goals outlined in plan adequate to achieve wolf recovery ?
- Can wolf management be customized as local or regional Recovery Zone goals are reached?

Note: This reflected questions related to different time to achieve recovery levels in NE relative to other Zones

WA RAMAS Model

- No data from WA existed at the time, therefore we used data from ID and MT

  Pack size, survival rates, reproductive potential, Dispersal, Habitat Suitability
- Model validated using population growth estimates from ID and MT
- Evaluated Importance of Immigration from neighboring populations
- Evaluated statewide recovery impacts of lethal removals in NE

We used RAMAS Risk Analysis software (http://www.ramas.com/) to project wolf breeding pair occupancy and terminal quasi-extinction risk (probability of falling below recovery goals over a 50 year time period) to examine the affects on recovery at different lethal removal and immigration scenarios.

Quasi-Extinction Risk (at time 50 years)

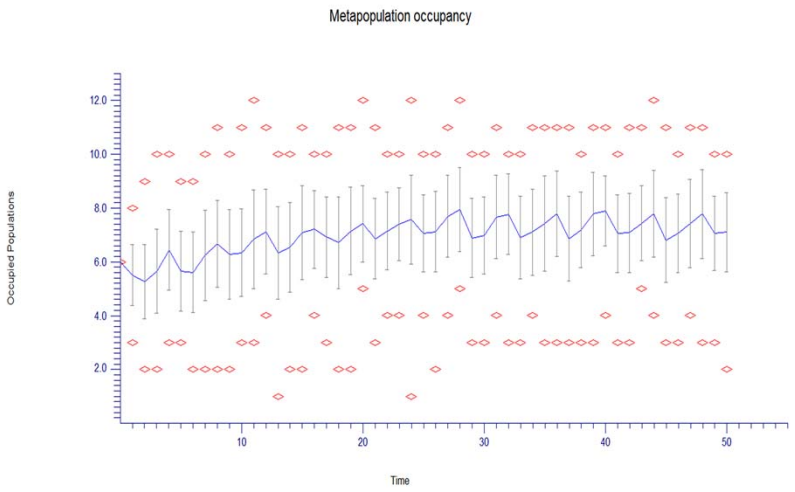
Probability E WA population is below Breeding Pair Threshold, modeled at varying levels of added annual human related mortality

Breeding Pair Threshold	Mortality Level 0.1	0.2	0.3	0.5
1				0.01
2				0.03
3			0.03	0.06
4	0.01	0.01	0.1	0.21
5	0.01	0.02	0.21	0.29
6	0.02	0.03	0.42	0.48
7	0.04	0.04	0.66	0.75
8	0.07	0.1	0.8	0.89
9	0.16	0.17	0.9	0.98
10	0.26	0.33	0.95	0.99
11	0.33	0.47	0.97	1
12	0.45	0.6	0.98	
13	0.57	0.77	0.99	
14	0.73	0.85	0.99	
15	0.81	0.95	1	
16	0.91	0.96		
17	0.96	0.99		
18	1	1		

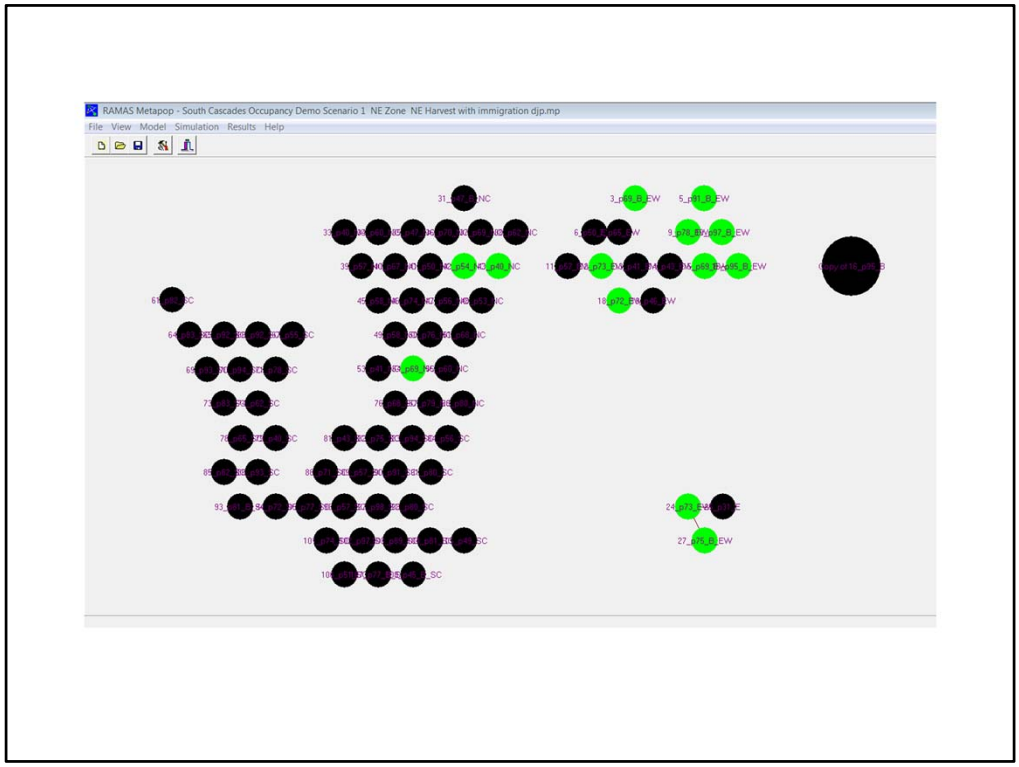
Recovery goals for eastern Washington have a high probability of being met (>99%) at the end of 50 years with additional 10 % or 20% annual mortality above the modeled mortality rate of 28%. Probability of meeting Eastern Washington recovery goals decreases substantially when additional annual mortality levels exceed 20%.

Eastern Washington Recovery Zone Occupancy Levels

Model with 30% Lethal Removal every 4 years in NE



The number of breeding pairs in Eastern Washington recovery zone remains at or above recovery levels or 50 years time frame, under additional human caused mortality (lethal removal)

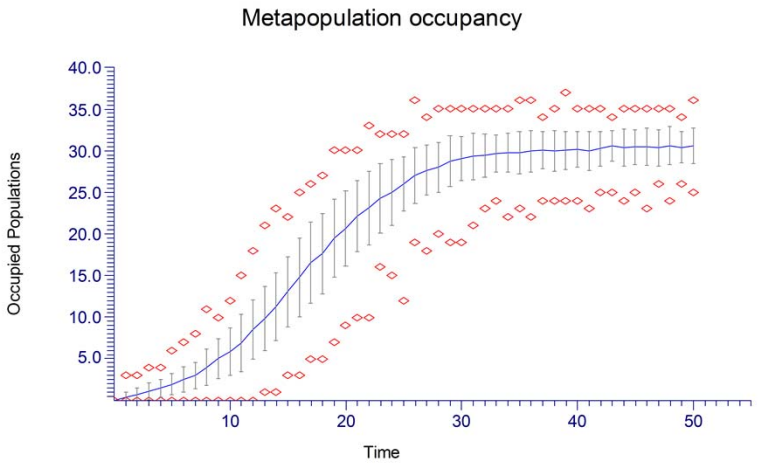


Refer to Appendix G in the Wolf Conservation and Management Plan.

Assumptions/parameters used in RAMAS model:
1) Pack territory size of 933 km2 (360 mi2) based on data from Idaho (n = 13, USFWS 2000) and Washington (n = 2).
2) Survival data from northwestern Montana (Smith et al. 2010), except pup survival of 0.81 (see discussion in Appendix G).
3) Four hypothetical packs were used to mimic a low level of immigration, two in British Columbia and one each in northern Idaho and Oregon, except when simulations assumed no immigration.
4) Frequency of successful dispersal between packs was a function of distance; maximum dispersal distance used was 200 km (124 miles).
5) Average pack size = 8 individuals.
6) Average litter size = 4 pups.
7) For scenarios where growth was limited and territories were selected, territories with the highest probability of occupancy (based on the suitable habitat model) were used where possible, while maintaining recovery region pack delisting requirements.
8) Inbreeding depression was not included.

South Cascades and Northwest Coast Recovery Zone Occupancy Levels

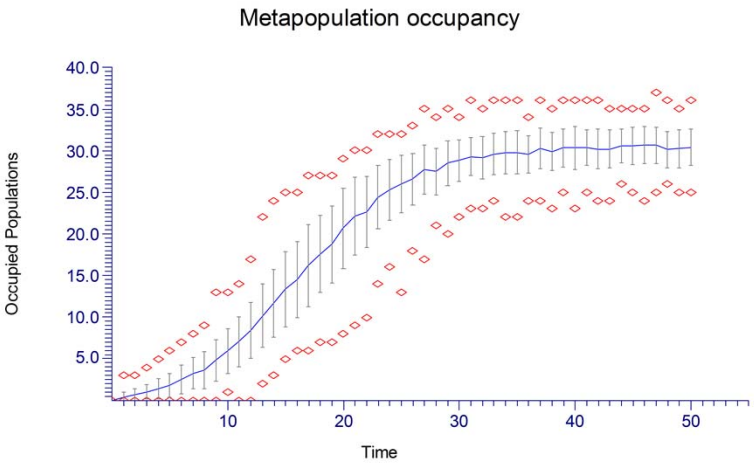
Model without Lethal Removal in NE



Without additional human caused mortality (beyond the 28% included in the base model), the wolf population in the South Cascades and Northwest Coast recovery zone is expected to reach 4-5 breeding pairs (occupied populations) in 7-9 years. The modeled range in years reaching 4-5 breeding pairs could be as short as 2 years or as long as 15 years.

South Cascades and Northwest Coast Recovery Zone Occupancy Levels

Model with 30% Lethal Removal every 4 years in NE



There is little if any delay in reaching wolf recovery goals in the South Cascades and Northwest Coast recovery zone when additional human caused mortality is increased (30% every 4 years) in the NE WA population. Compare with previous slide.

NOTE: The results of this exercise are not considered definitive, and vary widely depending on the assumptions used, especially about wolf survival and immigration.			
Scenario (100 simulations, 50 years)	Parameter[a]	Result	Conclusion/Notes
1. Statewide growth, 73 possible territories, start with 2 occupied territories, assume immigration	Tx	0	With immigration, wolves would maintain about 58 packs (under these assumptions[e], and modeled habitat).
	Mo	58.3 (52-67)	
	Qx	0	
2. Statewide growth, 73 possible territories, start with 2 occupied territories, assume no immigration	Tx	0.02	With no immigration, the population may grow to 56 packs, but there is a 2% chance it would decline to extinction.
	Mo	45 (0-57)	
	Qx	0.02	
4. 23 packs (distributed as 9 EW, 7 NC, 7 SC) to approximate the 6/4/5 recovery objective, no additional growth, assume immigration	Tx	<0.01	When recovery objective of 15 successful breeding pairs met and immigration assumed, the likelihood of needing to relist is high (0.93).
	Mo	19.2 (14-22)	
	Qx	**0.93**	
6. Recovery objectives (i.e., 6 breeding pairs) met in the Eastern WA recovery region, but not in the other two recovery regions; assume immigration, management	Tx	<0.01	Conducting wolf management in the Eastern WA recovery region after recovery objectives are met there, but before regional objectives are met in the other two regions, will not inhibit the ability to achieve recovery in all three regions over time.
	Mo	57 (47-64)	
Quasi-extinction at statewide level (<46 adult+dispersing females)	Qx	<0.01	
7. Recovery objectives (i.e., 6 breeding pairs) met in the Eastern WA recovery region, but not in the other two recovery regions; assume immigration, management	Tx	<0.01	Conducting wolf management in the Eastern WA recovery region after recovery objectives are met there, but before regional objectives are met in the other two regions, will not inhibit the ability to achieve recovery in eastern WA; model assumed 2 of 6 pairs established in Blue Mountains.
Quasi-extinction at recovery region level (<12 adult+dispersing females)	Mo	11 (6-13)	
	Qx	<0.03	

Overall conclusion from the modeling is that:

1) the recovery goals outlined in the plan are adequate to achieve recovery, assuming these goals are not treated as a “cap” and social tolerance of wolves allows the wolf population to fill unoccupied habitat.

2) increased levels of human caused mortality in the NE region (that include current levels) will not affect the ability of wolves to achieve statewide recovery goals.

This table is copied from the Appendix H in the Wolf Conservation and Management Plan. Results of nine scenarios of wolf population modeling in Washington using RAMAS (see Appendix G in the plan).