Synthesis of April, June, and November 2022 Wolf-Ungulate Interactions Presentations to WAG

A substantial amount of science-based information on wolves, ungulates, and their interactions was presented by a variety of speakers at the April and June 2022 Wolf Advisory Group (WAG) meetings. Washington Department of Fish & Wildlife (WDFW) staff also provided a brief overview of wolf management policy with respect to ungulates at the November 2022 WAG meeting. To prepare for the January 2023 WAG meeting discussion, members of the Wolf-Ungulate Interactions Task Group synthesized the key takeaways below (these were reviewed by Task Group members prior to distribution). While this synthesis is immensely helpful in distilling the key information presented, WAG members and WDFW are encouraged to review the presentations and reference materials in their entirety, as linked in the January 2023 WAG member agenda.

Preamble

(prepared by Annemarie Prince, WDFW, Wolf-Ungulate Interactions Task Group)

Some WAG members have more interest in the wolf/ungulate interaction discussion than others. Some members may have been wondering why we are spending so much time talking about ungulates, and how WDFW manages and counts ungulates, at meetings about wolves.

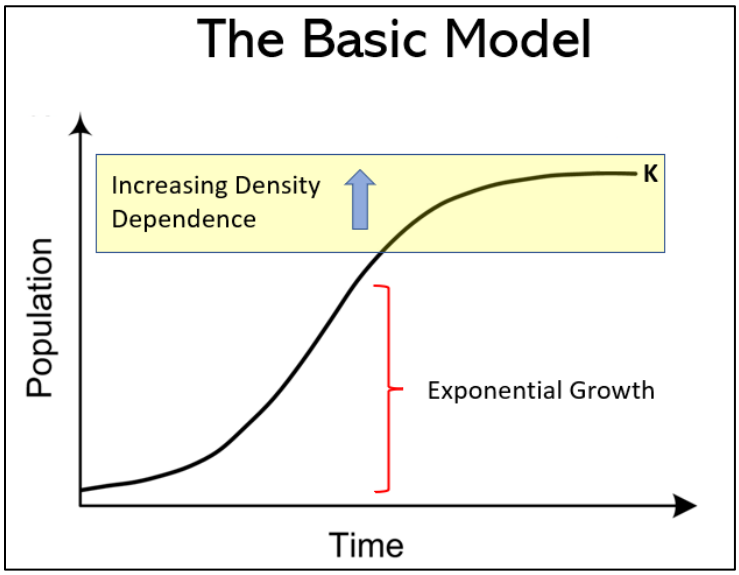
To answer that question, it's easiest to think about different members of the WAG and members of the public and their relationship with ungulates. The relationship we may think about most (and that WDFW has a responsibility to focus on) is the relationship between hunters and ungulates. We know wolves must eat ungulates to survive and, therefore, the big question is: "how do we balance what wolves need to eat and what hunters need (or want) to eat?" *We know there are other values surrounding ungulates, but this is the big one many people focus on when it comes to wolves*.

As WDFW moves forward seeking advice from the WAG about how to manage (not using "manage" to imply "hunting") wolves in a post-delisting or recovered wolf population world, the WAG needs to have a solid background on wolf-ungulate interactions, including information on what impacts wolves do and don't have on ungulates, and how this may or may not impact a hunter's ability to harvest an ungulate for their consumption. WDFW wants WAG members and members of the public to have realistic expectations for what to expect for the wolves and the ungulates when certain management actions are taken (e.g., habitat modification, changes in hunting seasons/regulations, predator management, etc.).

April 26-27, 2022 WAG Meeting

(synthesized by Todd Holmdahl, WAG, Wolf-Ungulate Interactions Task Group)

Fundamental Dynamics of Ungulate Population Dynamics (see glossary)
—Dr. Scott McCorquodale, WDFW



1. Basic model of ungulate population growth is exponential growth until flattens at an asymptote.
   - First phase is colonization phase
   - Next phase of exponential growth is irruption phase
   - When you hit the asymptote, you are at the resource limitation equilibrium
2. When looking at per capita nutrients and energy the following occurs with respect to the basic model
   - Colonization phase – nutrients are very high, nutritional limitation absent, optimal seasonal intake, intraspecific competition limited
   - Irruption phase – nutrients are very high to high, nutritional limitation low, near optimal seasonal intake, intraspecific competition with low consequence
   - Asymptote – nutrients are low, nutritional limitation pronounced, seasonal intake constrained, intraspecific competition high and consequences
3. When looking at individual nutritional condition the following occurs with respect to the basic model
   - Colonization phase – Excellent and low variability
   - Irruption phase – Excellent to very good, may be lower for lactaters
   - Asymptote – modest, low for lactate, high variation, slow maturation, and low mass

4. When looking at survival in this model
    - Colonization phase– Excellent for adults; good for neonates and juveniles
    - Irruption phase – Very high for adults; may decline in neonates and juveniles
    - Asymptote – high to modest for adults, but may be poor in severe winters and for the old; modest in neonates and low in juveniles in severe winters
5. For productivity in the basic model
    - Colonization phase – Exceptional; high for first time breeders, pauses rare
    - Irruption phase – high; good for time breeders; pauses uncommon
    - Asymptote – Pregnancy reduced, recruitment impacted, poor for first time breeders and earlier menopause, pauses common
6. Carrying capacity concepts (Ecological Carrying Capacity, ECC)
    - Theoretical maximum number of animals
    - Strong impact to vegetation
    - Difficult to estimate finitely, don't know until we get there
    - It is dynamic
    - Most agencies don't manage to ECC (e.g. hunting)
7. In the real world, you will see animals oscillate around the carrying capacity. As you get closer to ECC:
    - Decreased juvenile survival
    - Increased age of first reproduction
    - Decreased age-specific fecundity
    - Decrease adult survival
8. Other Important terms
    - Limiting factor
    - Regulating factor
    - Compensatory mortality
    - Additive mortality

Factors that Influence Ungulate Populations—Dr. Melia DeVivo, WDFW

1. Factors that influence population size –
    - Climate (density independent)
    - Human activity (density independent)

- Predators – (density dependent)
- Resource competition – (density dependent)
- Parasitism & disease – (density dependent/independent)

2. Parasitism & Disease
    - All wildlife are diseased, but some don't succumb
    - Generally density dependent but are situations that are independent (e.g. hemorrhagic disease)
    - CWD is primarily a density dependent disease and associated with population declines in deer and elk. Reduces adult survival.
3. Resource competition
    - How animals acquire food, water, and shelter
    - Density dependent factor
    - Example of how it impacts a species is migration. Some species will remain resident, some will do full migrations, and some will partially migrate
4. Predators
    - The killing of one organism by another for food
    - Effects
        - Individual level – Animal lives or dies
        - Population level – prey vulnerability influenced by age, sex, nutritional condition, disease, weather, location, and time of day
        - Community level – stabilize, destabilize, or have no impact
        - Predation can be compensatory and additive – typically a continuum.
        - Griffin et al 2011 – Bears had completely additive impact on neonate ungulates. Cougars, wolves, coyotes more on a continuum.
        - Indirect effects of predators as well.
5. Climate
    - Example of climate impact - Moose populations below NCC nutritional carry capacity (stable) do not change with the climate (e.g. hot summers and cold winters). When moose populations were close to NCC, a change in climate did impact the moose population.
    - Climate and predation effects – Winter precipitation increased adult female elk mortality in population sympatric with wolves
    - Climate and disease effects – model shows that climate change will increase deer hemorrhagic disease because of increased distribution of carrier insect

6. Human Activity
    - Direct and indirect impact impacts
        - Harvest
        - Fences
        - Habitation
        - Feed animals to reduce conflict
        - Changes their behavior
    - Harvest tends to be additive mortality

Ungulate Monitoring in Washington State—Anis Aoude, WDFW

1. Elk
    - Management criteria: pre-hunt bull:cow ratio, post-hunt bull:cow ratio, estimated bull mortality, percent six point or better, population objective
    - Population objectives much lower than carrying capacity – usually target a social carrying capacity
    - Use population objectives to drive more liberal or conservative hunting seasons
    - Use aerial sight-ability, ratio surveys, harvest composition
    - Statewide elk herds seem pretty stable with slightly downward harvest trend over last 21 years
2. Deer
    - Deer management all based on ratios – hard to count and carrying capacity changing often
    - Whitetail deer Buck Harvest in District 1 fairly stable and declining slightly over last 21 years. Fawn to doe ratios stable around 50 to 60%. Buck to doe stable around 30% (preseason)
    - Black tail deer most secretive deer. Mainly buck harvesting is used to manage population. Buck harvest trends flat for last 14 years
    - Mule deer – May go to permit system as not as dense as we would like them to be. Mule deer harvest appear stable from 2008 to 2021
3. Moose – new to Washington. Estimate five thousand moose in 2016. Manage around bull to cow ratios.

4. How do we compare to other Western States– looking at elk as habitat is similar to wolf?

- Sixty thousand elk, 107 people per square mile, 127 people per elk, three hunters per elk, (200 to 300k hunters per state) – correlation (not causality) shows Washington population inversely correlated with deer and elk harvests.

June 22-23, 2022 WAG Meeting

(synthesized by Paula Swedeen, WAG, Wolf-Ungulate Interactions Task Group, and Lynn Okita, WAG)

Some thoughts on the relationship between wolves and their prey —Dr. John Vucetich

1. Bottom up versus top-down influences in predator-prey ecosystems: whether one force is dominant or the other depends on other things going on in the ecosystem, and it can change over time.

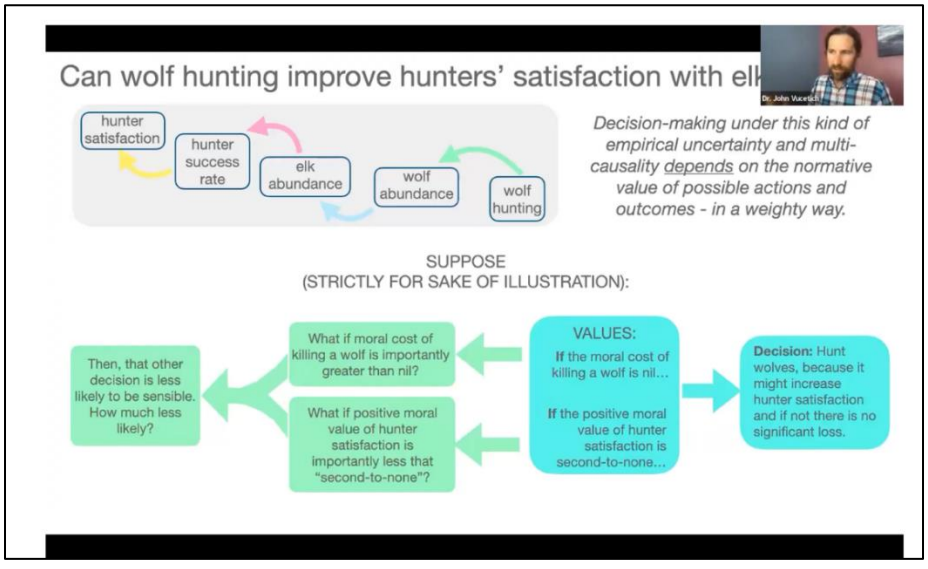
2. He demonstrated this through long-term dataset looking at wolf-moose dynamics in the Isle Royale ecosystem.

3. It may take years after the period of time under study to be able to discern the causal relationships among all the factors that affect predator-prey relationships.

4. Prey abundance is simultaneously influenced by predation, hunting, habitat quality, and weather.

    - It is not clear that hunting wolves increases ungulate populations; lots of other factors affect ungulate abundance, and ungulate abundance is not the only determinate of hunter satisfaction. Therefore: "Decision-making under this kind of empirical uncertainty and multi-causality depends on the normative value of possible actions and outcomes – in a weighty way."

    - Values intersect with science.



Some insights from predator-prey research in Greater Yellowstone Ecosystem —Dr. Arthur Middleton

1. Yellowstone elk population on the Northern range was way too high and managers were trying to deliberately drive the elk numbers down from 20,000 because they were destroying the vegetation base (eating into the principal of the ecosystem). They employed very intense hunter harvest to do so and wolves played a bit role in the population reduction/decline. (Sub-point – the northern Yellowstone Elk herd spans both inside and outside the Park. Hunting used outside the Park.)

2. There are tens of thousands of elk in the GYE and all herds interact with wolves. The relationship between wolves and elk is different in different herds but elk numbers are pretty stable (except for the northern herd during the first 10 years – see above).

3. Wolves caused only small and infrequent movement disturbances and there were no associations between wolves and body fat or pregnancy in elk. Body fat is influenced by summer foraging and forage nutrition. Very hot, dry summers limited pregnancy.

4. Several elk herds in the Yellowstone ecosystem are impacted by grizzly predation on elk calves – a larger source of mortality than the other predators.

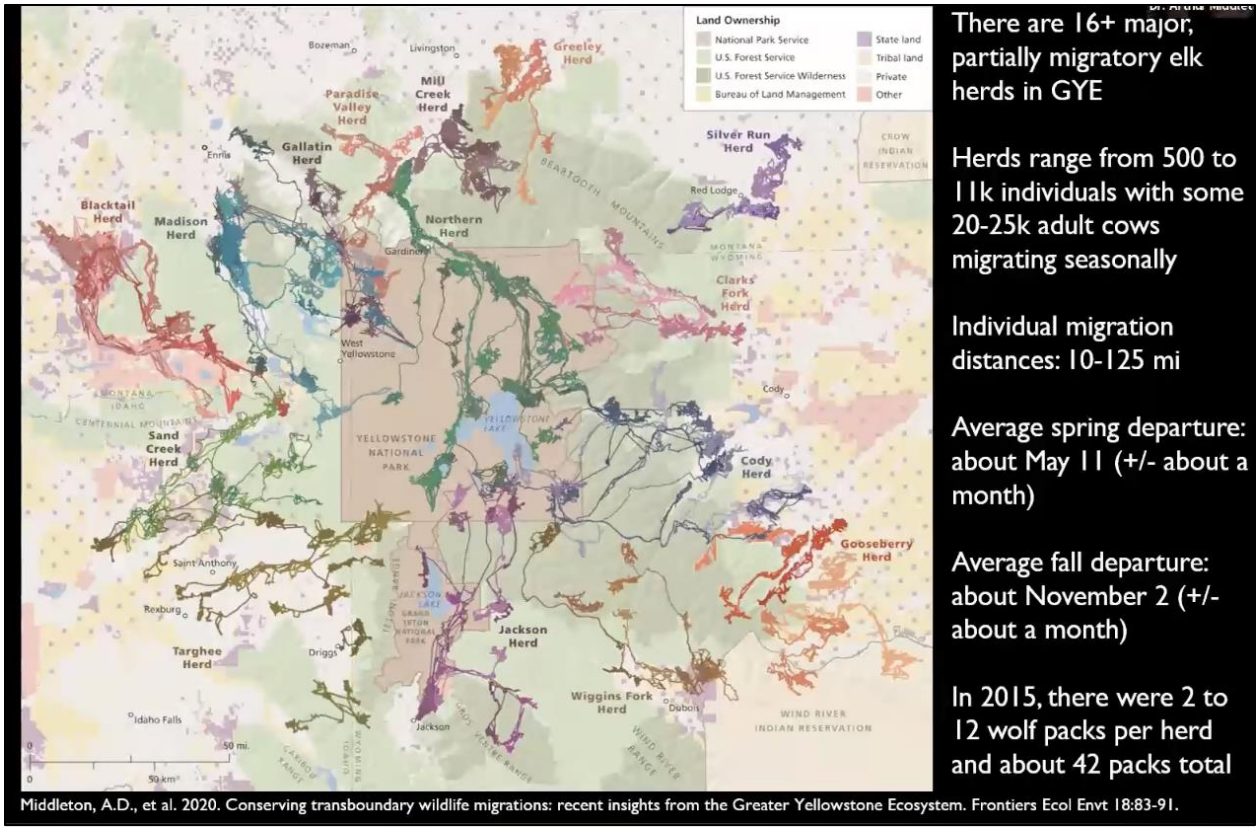
5. There is an elk herd in the GYE that he studied that has both wolves and grizzlies and its numbers, including cow/calf ratios are stable and high. Need to remember to study the places where no impact is occurring in addition to places where some impact is occurring.

6. Wolf hunting in the Clarks Fork herd has had minimal effect on elk productivity and harvest.

7. “Reasonable hypotheses about predator-prey dynamics can fall apart in a vast complex landscape with resilient prey.”

8. Data cannot be taken from one population, location, and period and applied to another without caution (from Q + A).

(see image page 8)



Density-dependent changes in wolf predation within the complex system of northern Yellowstone—Dr. Matthew Metz

1. Focused on northern range of Yellowstone

2. Humans target younger female elk in hunting take that are part of the reproductive age of the population.

3. Wolves target older, more vulnerable elk that are less likely to be pregnant, which is one reason they do not have as high an impact on elk populations as one might expect. Wolves have a lower success rate at hunting than cougars.

4. Cougars do not target older, vulnerable elk as much; they target more across age class distribution.

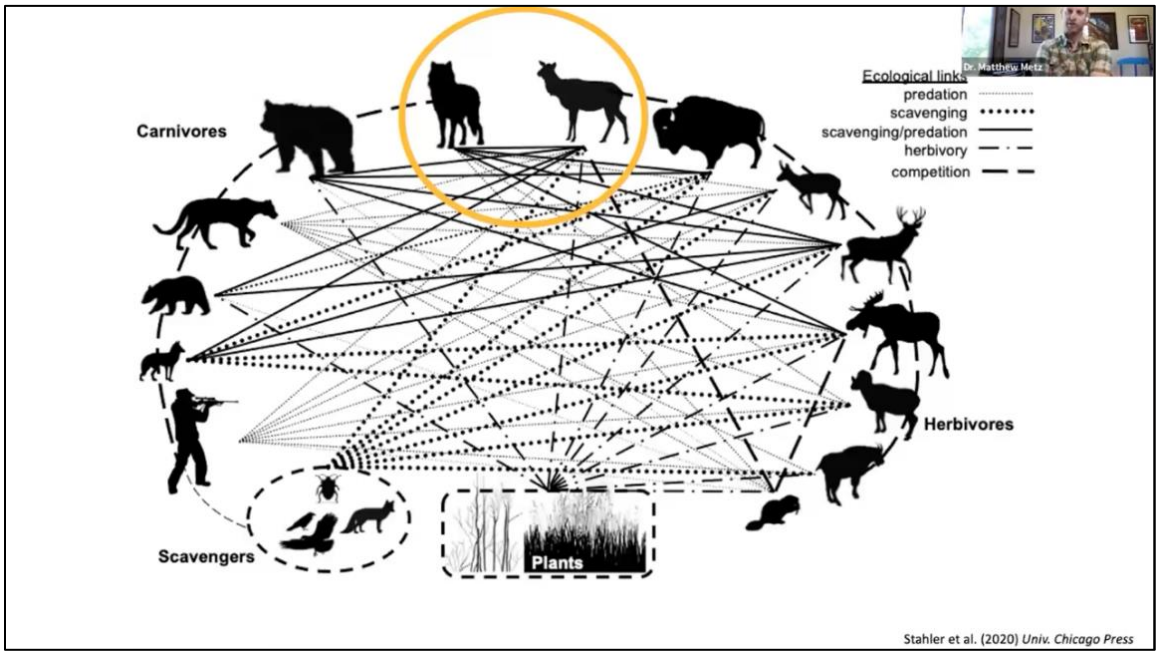
5. Grizzly bears kill more elk calves than other predators - 2.5x that of wolves.

6. Across the Rocky Mountain west, wolves do not seem to have a significant impact on neonate survival. Cougars have some negative impact and grizzlies have a large negative impact.

7. However, wolves do eat elk calves; they are an important part of their diet in the summer, especially.

8. Density-dependent predation: Diet composition, kill rate, predation rate (percent of prey population removed by a predator)
    - For diet composition, the amount of biomass of elk in wolf diet has decreased over time while the amount of bison has increased, with most bison acquired through scavenging bison carcasses of animals that did not survive the winter. Wolves started to kill more mule deer over time but because they are smaller animals, the proportion of biomass in their diet is smaller than elk and bison.
    - There has been a density-dependent change in the number of cow and calf elk killed by wolves in late winter, though not in early winter – i.e., as elk populations have declined, there is little change in the number of animals killed in early winter, and there is a change (decline) in number of elk killed in late winter.
    - For bull elk, fewer killed during early years with high population, then more as population declined.
    - Hunter harvest and weather had the biggest impact on the elk population in the first 10 years after wolf re-introduction, and it looks like in the past 15 years, that 1) elk numbers are much more stable and that 2) they are being regulated by a combination of predators: human, wolves, cougars, and grizzly bears.

9. Yellowstone is a complex food web with a number of both top-down and bottom-up influences, not easy to isolate what wolf influences on elk populations are.



November 2-3, 2022 WAG Meeting

(synthesized by Annemarie Prince, WDFW, Wolf-Ungulate Interactions Task Group)

Introduction and context: Gray Wolf Conservation and Management Plan—Annemarie Prince, WDFW

What does the Gray Wolf Conservation and Management plan say about management actions taken to bolster ungulate populations if wolves are limiting them?

1. If WDFW determined that wolf predation was a primary limiting factor for an "at-risk" ungulate population, and the wolf population in that wolf recovery region was at least four successful breeding pairs, WDFW could consider reducing wolf abundance in the localized area occupied by the ungulate population before state delisting occurs.
    - For the purposes of this plan, an at-risk ungulate population is any federal or state listed ungulate population (e.g., Selkirk Mountain woodland caribou, Columbian white-tailed deer).
    - An at-risk population would also include any ungulate population which falls 25% below its population objective for two consecutive years and/or if the harvest decreases by 25% below the 10-year average harvest rate for two consecutive years.
    - In ungulate populations without numeric estimates and/or without management objectives, the Department will rely on other factors of information to assess a decline, such as harvest trends, hunter effort trends, sex and age ratios, and others.
2. Under this form of management, wolves would be controlled by moving them to other areas, through lethal control, and/or with other control techniques.
3. While wolves are recovering, nonlethal solutions will be prioritized to be used first.
4. Before deciding to proceed with this type of management, WDFW would consider the status of wolves statewide as well as within the specific wolf recovery region where the ungulate impact is occurring.
5. The extent of wolf control undertaken would not be sufficient to push the region's overall wolf population below delisting objectives and put it at risk. Management decisions of this type would be based on scientific principles and evaluated by WDFW.