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Dead Deer Do Tell Tales: Use of GPS Data to Infer Cause of Mortality in Mule Deer

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Declining Deer: Uncertain Causes

• Decreasing mule deer populations across western North America led to many studies addressing the decline (Unsworth et al 1999)

• Possible contributing factors are predation, habitat quality, disease, interspecific competition, or human-caused disturbances (Gill et al 1999).

• Many studies outfit deer with GPS collars. While frequently used to examine habitat use, parturition, and timing of death, no research has been done to test if GPS data can be used to determine cause of death.

• Research Question: can spatial analysis of GPS data be used to determine cause of mortality?

• Many mortalities go unrecovered for long periods of time, leading to uncertainty about cause of death

• If GPS data can infer cause of death, managers could have a better understanding of declining populations. Previously collected mortalities could also be assigned a cause of death, providing answers for past datasets as well.

Methods

• Deer in the Piceance basin of western Colorado were captured and collared from 2008 to 2018.
• Collars logged GPS and activity every 5 hours, and signaled mortality after 8 hours of inactivity.
• Daily monitoring of survival from the ground. Upon mortality, ground crews retrieved the collar and determined cause of death.
• Data downloaded from collars upon retrieval.
• Known-mortality dataset compiled (n=60) and entered into ArcGIS to calculate slope, habitat type, movement, and area of GPS data pre- and post-mortem.
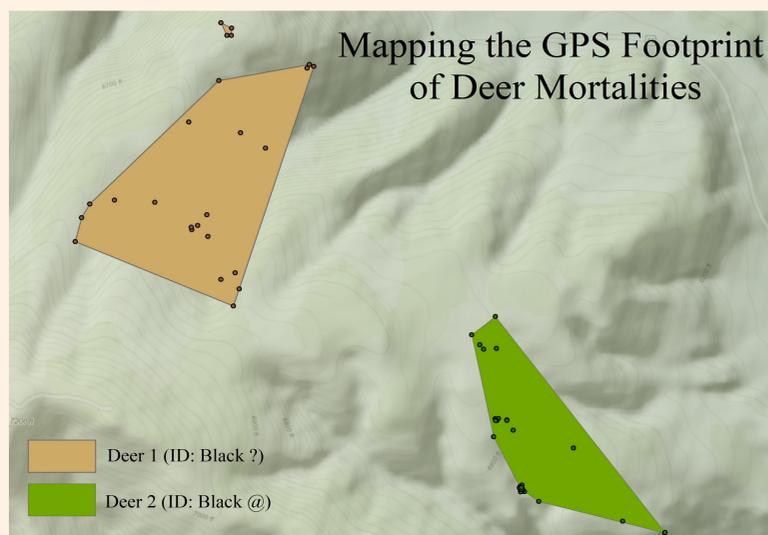• Model development and testing in R (currently underway)

Mapping the GPS Footprint of Deer Mortalities

Deer 1 (ID: Black ?)
Deer 2 (ID: Black @)

Figure 1. Range of two deer pre- and post-mortem in ArcMap

Preliminary Findings

• Deer that died of malnutrition or disease showed less movement before and after death than other deer

• 10% of deer had no activity registered after death

• 80% of deer died in shrub or evergreen habitats

• 58% of coyote predations occurred January 15 – March 30

• Preliminary models suggest discerning between different predators may be difficult

• Activity values may help determine predation vs non-predation

• Current model with the strongest weight has distance pre-mortem and activity values as covariates

• Final results pending
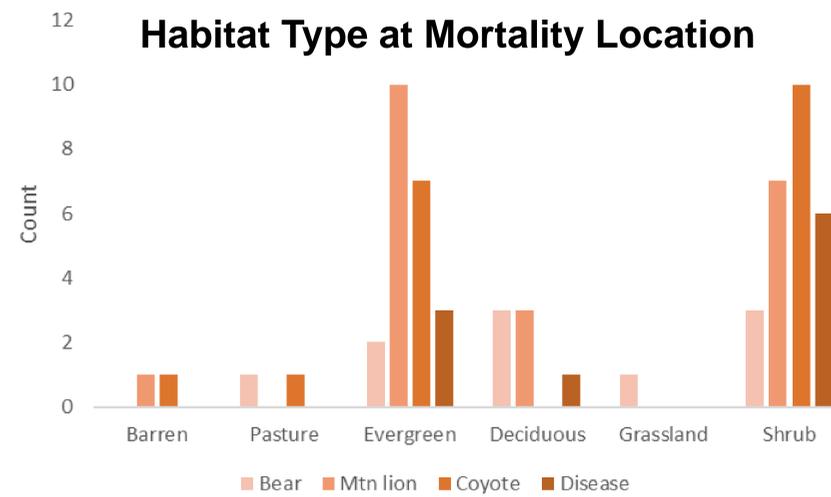

Figure 2. Dominant habitat type at location of mortality by each cause of death

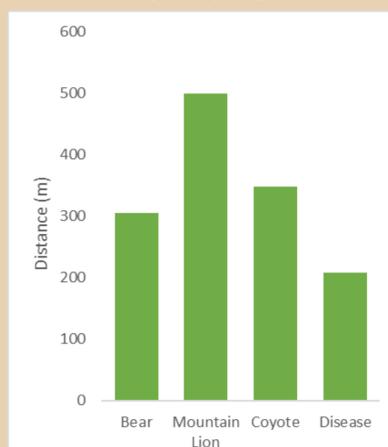
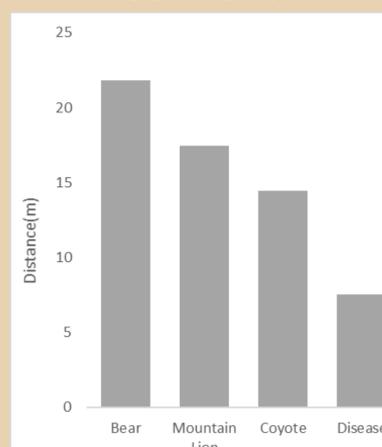
Figure 3. Average distance moved prior to death for each mortality cause

Figure 4. Average distance moved after death for each mortality cause
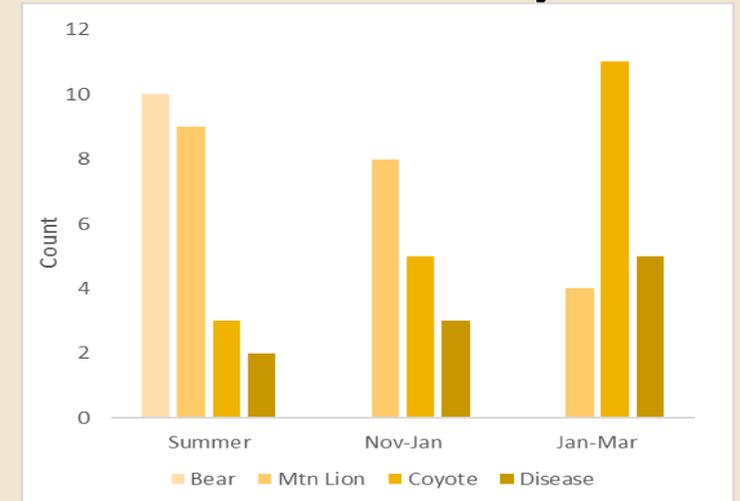

Figure 5. Season of mortality by different mortality causes

Conclusions and Implications

• Discerning between different predation events may not be possible using GPS data alone.

• GPS data may possibly help tell predation-caused mortalities from non-predation mortalities.

• If managers want to know the specific cause of death, they should prioritize retrieving mortalities as soon as possible to determine cause of death.

• However, leaving the collar on the body for a few more days could provide more GPS data post-mortem and lend further insight into using GPS data to determine cause of death in the future.

• Larger data sets of known mortalities could provide more clarity in discerning between mortality causes.

• Higher resolution data, with collars that take point every 30 minutes to half an hour, would also provide greater ability to parse out the difference between different causes of mortality. The 5-hour time span of this study misses much of the movement around the time of mortality.

• I would recommend that future studies interested in this use higher-resolution collars and attempt to gather more data post-mortem, while also establishing cause of death as soon as possible

Literature Cited

Gill, R.B., T.D.I. Beck, C.J. Bishop, D.J. Freddy, N.T. Hobbs, R.H. Kahn, N.W. Miller, T.M. Pojar, and G.C. White. 1999. Declining mule deer populations in Colorado: reasons and responses.

Unsworth, J.W. D.F. Pac, G.C. White, and R.M. Bartmann. 1999. Mule Deer Survival in Colorado, Idaho, and Montana. *The Journal of Wildlife Management,* **63**(1): 315-326.

Acknowledgments