

Climatic Conditions and Migration Distance Drive Timing of Autumn Migration in Mule Deer

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Seasonal migration is a behavioral strategy that animals have evolved to exploit seasonally changing resources. A predictable pattern for many ungulates in northern temperate landscapes is to seasonally migrate from low-elevation winter ranges to higher-elevation summer ranges, allowing individuals to exploit a diversity of forage resources during summer while avoiding extreme winter conditions. In Montana, ungulate migrations often cross multiple hunting districts, and the timing of autumn migration often coincides with hunting seasons. Here, we utilize GPS collar data during 2017-2019 from 68 female mule deer (*Odocoileus hemionus*) spanning three distinct study areas in northwest Montana to evaluate the spatial and temporal patterns behind autumn migration. We first conducted descriptive summaries of the timing of autumn migrations with respect to hunting district boundaries and found that deer spanned multiple (up to 8) hunting districts across all 3 study areas. While many deer returned to winter range during archery season, some remained in wilderness until after the general rifle season concluded. Next, we related the timing of autumn migration to environmental variables like precipitation, snow depth, temperature, plant phenology (NDVI), migration distance, and estimates of relative hunting intensity. In addition, we summarized climatic and hunting variables across multiple temporal scales (2-day, 1 week, and 2 week) to identify possible lagged or cumulative effects of environmental conditions on mule deer behavior. We found that plunging minimum temperatures provided a strong cue for mule deer to begin their migration back to winter range.