A Comparison of Nutritional and Foraging Ecology of Sympatric Mule and White-tailed Deer

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Mule deer (Odocoileus hemionus) and white-tailed deer (O. virginianus) are the only 2 extant species in their genus, are similar in morphology and life history, and can hybridize where sympatric. However, their distributions are segregated across much of their ranges in North America, with a zone of overlap primarily along the Rocky Mountains from Canada to Mexico (Fig. 1). Although these deer have been extensively studied in areas of both allopatry and sympatry, the role of potential differences in their fundamental dietary niche in shaping each species’ distribution has yet to be explored. Previous studies documented a wide range of dietary overlap between the species depending on location, but have been unable to determine whether the extent of dietary overlap reflects differences in dietary or habitat niches because diet composition was confounded with habitat use in these studies. Therefore, we compared nutritional ecology of mule and white-tailed deer in a common garden experiment during which tractable individuals of each species were allowed to feed together in the same habitats across a wide range of forage conditions in dry conifer forests in northeastern Washington, USA. We hypothesized that if mule and white-tailed deer truly differ in their fundamental dietary niche, we would detect differences in their diet composition caused by differences in foraging behavior, dietary quality, daily intake, or diet selection when they forage in the same space at the same time. Finally, we predicted that when forage biomass was low, diets of sympatric deer would overlap more frequently as they were forced to compete for limited resources.

Four female deer of each species were acquired as newborns from eastern Washington and hand-raised together. From June – August 2016, these animals were placed in 0.5-ha enclosures across 21 forest stands in areas of northeastern Washington where mule deer and white-tailed deer co-occur. In each enclosure, we measured biomass of all understory plant species, measured harvesting rates and diet composition of each deer using bite-count methods, and estimated daily foraging time using calibrated activity sensors. In addition, we measured the nutritional quality of each deer’s diet and major forage species found in each site. We compared foraging parameters between deer species using crossed random effects models with site and animal as grouping variables. We compared dietary similarity using the Bray-Curtis non-metric multidimensional scaling method. When living together in the same stands, both deer foraged for 44% of their day. However, mule deer took larger bites and harvested forage faster, whereas diets selected by white-tailed deer were more diverse and nutritious. Mule deer achieved a 20% higher daily digestible energy intake than white-tailed deer. Both species selected diets of mostly deciduous shrubs and forbs, but across the 119 species of plants consumed by all deer combined across all sites, estimated similarity of plant species in diets of mule deer and white-tailed deer was only 48%. Contrary to our expectations, deer diets were the least similar when the biomass of forages was either very low or very high (Fig. 2). Our results suggest that mule deer may be able to tolerate forages with more fiber and higher levels of some secondary metabolites, such as tannins. In addition, the dietary niches of the Odocoileus species may differ enough that they partition resources both when competing for limited forage and when food is so abundant they can each specialize. Confirming these
findings requires further studies comparing mechanics of foraging, digestion and detoxification by deer.

**Figure 1:** Distribution of extant populations of mule and white-tailed deer in North America.

**Figure 2:** The relationship between diet dissimilarity and acceptable biomass for mule deer and white-tailed deer across 21 forest stands in dry conifer forests in northeastern Washington from June – August 2016.