Effects of Wolf Predation on the Madison Headwaters Elk Herd: Insights for Elk and Wolf Management in Montana

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Studies of the non-migratory Madison Headwaters elk (*Cervus elaphus*) herd in Yellowstone National Park revealed that the herd appeared to be regulated near ecological carrying capacity by food limitation prior to the reestablishment of wolves (*Canis lupus*). Eleven years of post-wolf data indicated a substantial proportion of wolf predation was additive and overwhelmed any potential for the elk to demographically compensate. Thus, wolf predation resulted in a dramatic decrease in elk abundance and the system transitioned from being bottom-up regulated in the absence of a significant predator to strong top-down limitation due to wolf predation. It is uncertain if predation will ultimately regulate the elk population at a lower, alternate state or if predation and other factors influencing elk vulnerability will interact to result in further decreases in elk abundance. Fundamental to this question is the role of alternative prey and the interactions of winter severity and landscape heterogeneity on the vulnerability of elk to wolf predation. We contrast the impacts of wolf predation on elk in different drainages of the Yellowstone study area, as well as nearby areas studied outside the Park, to gain insights into the varying impacts of wolves on elk populations that occupy diverse landscapes in Montana. We suggest that wolves will have little to modest impacts on numbers of elk in most areas of the state, but that additive wolf predation could result in reduced elk numbers in some herds that winter in deep snow, forested environments where limited conflicts with livestock production can result in higher wolf: elk ratios.