

Linking elk energetic budgets to landscape use: implications for growth and reproduction

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Evidence suggests that ungulate populations may be limited by nutritional status and winter severity. Body fat accumulated during summer and autumn directly influences the probability of pregnancy, winter survival, and body-mass loss during winter. Delayed parturition is related to excessive winter body-fat loss by pregnant females, which limits the calf-growth period prior to the subsequent winter. We utilize a spatially explicit model that incorporates principles from behavior, physiology, morphology, and heat and mass transfer engineering to predict the spatial and temporal variation in the energetic costs and benefits for elk across three North American landscapes: Alberta, Canada; Wisconsin, USA; and Yellowstone National Park, USA. We use relocation data collected from GPS telemetry collars to examine whether elk movement and resource selection reflect the spatial variation in energetic costs predicted by model output. Our analysis is separated into two important seasonal periods: July and August, which represent the critical time of fat accumulation; and January and February, which represent the most severe winter conditions and the time when elk are trying to minimize body-mass loss. Elk alter habitat use in response to spatial variation in microclimate resulting from topography, vegetation cover and climate. Results enhance our understanding of the effects of the environment on growth and reproduction rates, and allow us to predict population carrying capacity as a function of landscape and climatic features.