Mule deer fawn recruitment dynamics in an energy disturbed landscape

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Abstract

Wildlife population dynamics are modulated by abiotic and biotic factors, typically climate, resource availability, density-dependent effects, and predator-prey interactions. Understanding if human-caused disturbances shape these processes is needed for the conservation and management of ecological communtiies within increasingly human-dominated landscapes. Garnering this understanding is difficult due to lack of long-term longitudinal data on wildlife populations, human-mediated disturbances, climate and predator density on ungulate population dynamics has been under-studied. Using a 50-year time series (1962-2012) on mule deer (Odocoileus hemionus) demographics, seasonal weather, predator density, oil and gas development patterns from the North Dakota Badlands to investigate long-term effects of landscape-level disturbance. We aimed to evaluate if harsh weather conditions in-combination with energy development and predators affected fall mule deer recruitment. We found that density-dependent effects and harsh seasonal weather primarily drove recruitment in the North Dakota Badlands. Recruitment was further shaped by interacting effects of harsh seasonal weather and predator presence in the form of high coyote density. Additionally, we found that fall recruitment was subtly modulated by interactions between seasonal weather and energy development (i.e., lower recruitment when harsher weather was combined with higher density of active oil and gas wells), and that the combined effect of predator density and energy development was not interactive but rather additive. Our analysis demonstrates the effect of energy development by modulating mule deer recruitment fluctuations concurrent with main recruitment drivers being biotic (density-dependency, habitat, predation) and abiotic (harsh seasonal weather, woody vegetation encroachment). A pattern emerges of density dependence, presumably due to limited quality habitat, being the primary factor influencing fall fawn recruitment in mule deer. Secondarily, stochastic weather events periodically cause dramatic declines in recruitment. Finally, the interactions between human disturbance and predation can be additive to the aforementioned drivers of recruitment and subsequently cause further declines.

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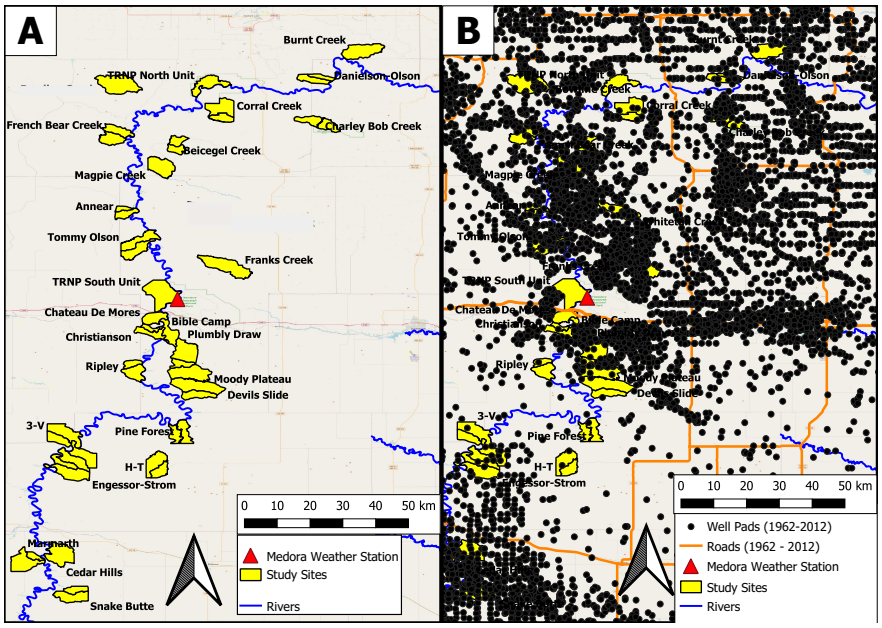

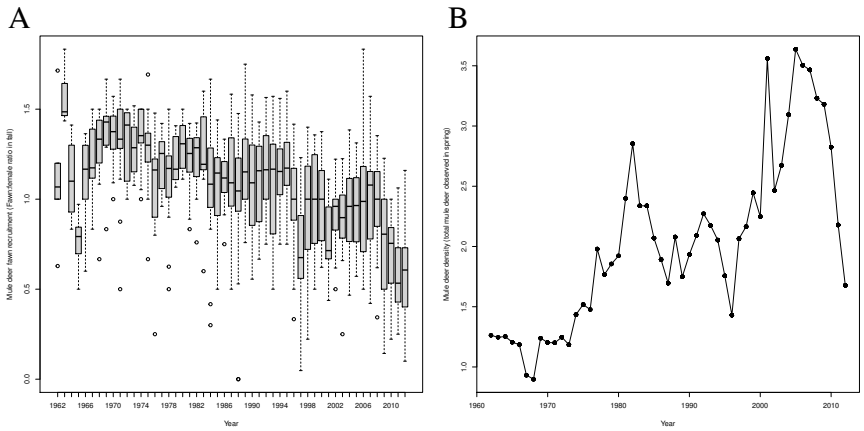

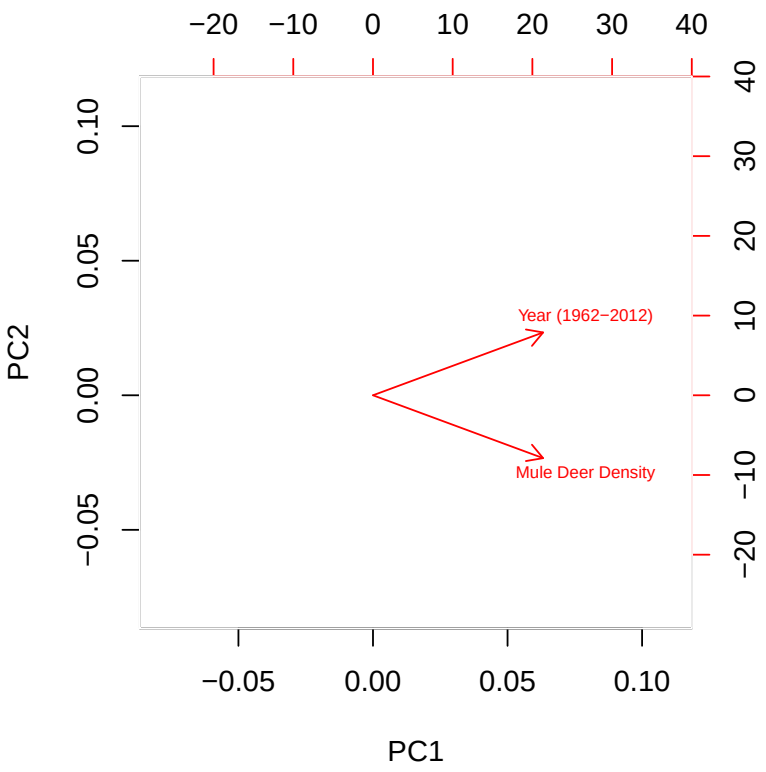

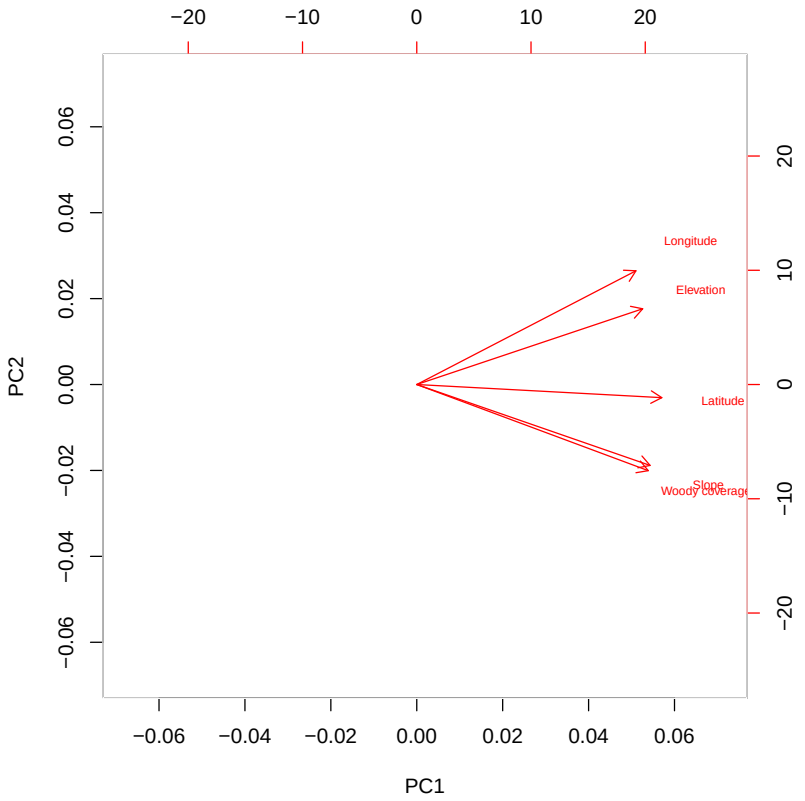

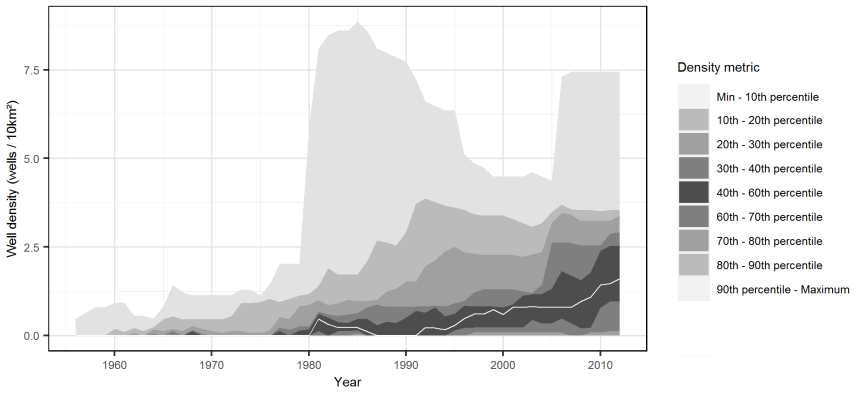

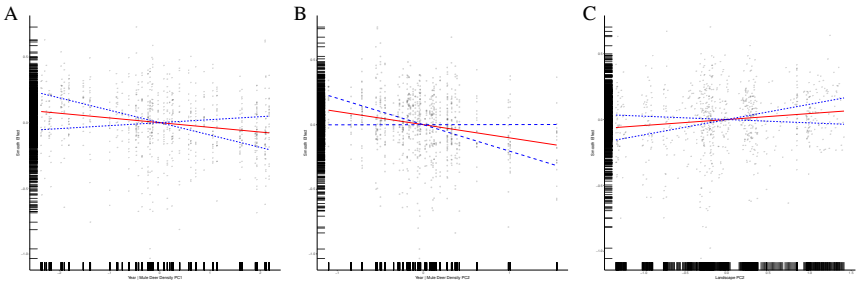

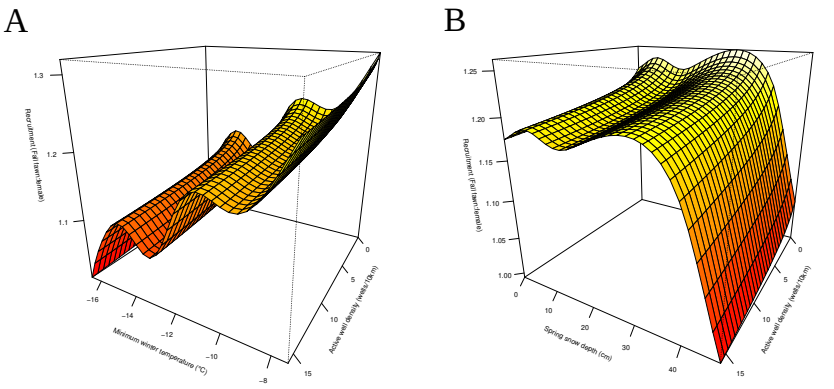

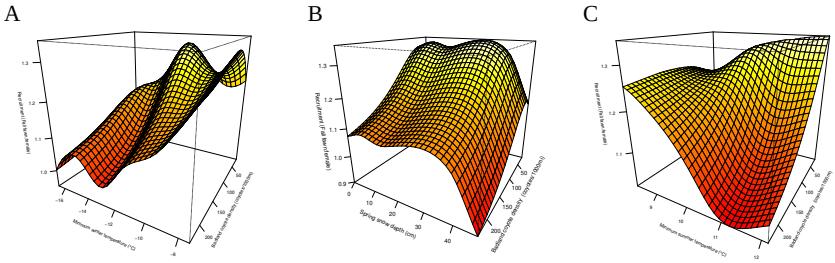

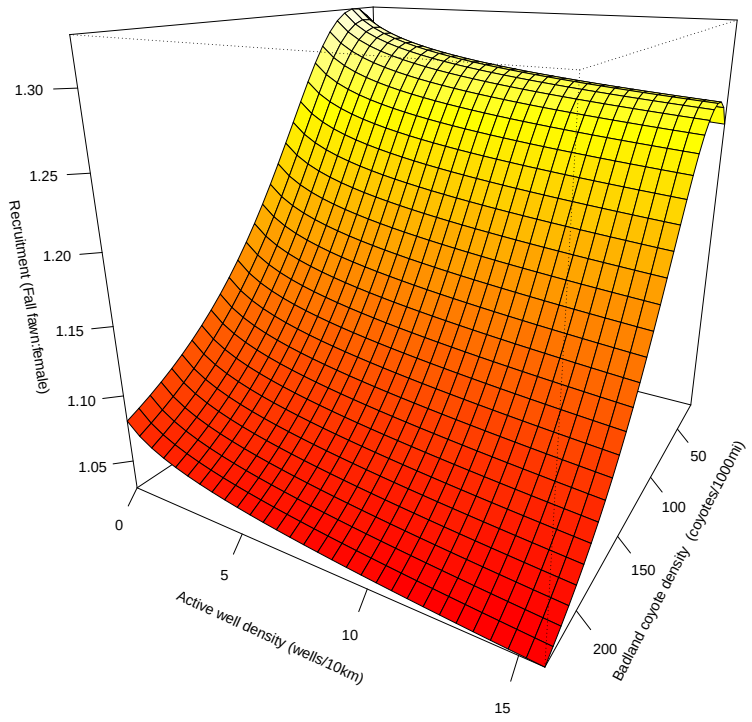

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