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EXPLORING THE RELATIONSHIPS BETWEEN SOUTH TEXAS NORTHERN BOBWHITE POPULATIONS AND CECAL WORMS VIA SYSTEM DYNAMICS

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ABSTRACT

Community ecology historically focused on plants and free-living organisms; however, problems such as defining habitat boundaries and obtaining adequate sample sizes arise when evaluating such communities. The unique nature of host-helminth systems allows parasite community ecologists to avoid these problems when testing ecological hypotheses. Unlike free-living communities that have artificially constructed boundaries, parasite communities have well-defined unambiguous boundaries within host individuals. Due to the inherently complex and dynamic nature of ecological systems, traditional experimental methods often require expensive, long-term trials beyond investigators' time and resource budgets. Conversely, a system dynamics approach facilitates learning about such systems via simulation of ecosystem processes integrated with historical data (both quantitative and qualitative). Relatively few studies focus on parasites in South Texas, USA, although research on avian host-parasite systems has shown that parasites can potentially regulate host populations. The northern bobwhite (*Colinus virginianus*; hereafter, bobwhite) is a game species of ecological, economic, cultural, and recreational importance in Texas that has been experiencing a long-term, widespread decline. To holistically examine the bobwhite-helminth system in South Texas, we created a system dynamics model capturing the feedback relationships between a South Texas bobwhite population, a grasshopper (family Acrididae) population, and the corresponding cecal worm (*Aulonocephalus pennula*) populations on a hypothetical 1,000-acre ranch in South Texas. The model structure, constructed in Vensim® PLE 7.2 software (Ventana Systems, Inc.), integrates the hypothesized biotic and abiotic drivers (precipitation, parasite load, insect abundance, and quail density) unique to the host-helminth system over 7 years (2012–2019). Our specific objectives were to 1) develop a working baseline model to replicate the synergistic population dynamics among bobwhite, grasshopper, and cecal worm populations and then 2) test hypotheses about each population's boom-and-bust cycles resulting from environmental stressors (e.g., drought). Applications of the model can provide landowners and natural resource managers with a better understanding of the complex dynamics occurring among bobwhite, grasshopper, and cecal worm populations in South Texas.

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Key words: *Aulonocephalus pennula*, cecal worm, *Colinus virginianus*, helminths, northern bobwhite, simulation model, Vensim

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