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Spreading speed of chronic wasting disease across deer groups with overlapping home ranges

Chronic wasting disease (CWD) is a fatal disease of cervid species that continues to spread across North America and now in Europe. It poses a threat to cervid populations and the local ecological and economic communities that depend on them. Although empirical studies have shown that host home range overlap and male dispersal are important in the spread of disease, there are few mechanistic models explicitly considering those factors. We built a spatio-temporal, differential equation model for CWD spreading with restricted movement of hosts within home ranges. The model incorporates both direct and environmental transmission within and between groups as well as male dispersal. We compared the relative influence of host density, sex ratio, home range size, and male dispersal distance on the spreading speed using sensitivity analysis. We also assessed the effect of landscape heterogeneity, quantified as edge density, on the spreading speed of CWD because it jointly alters the host density and home range size. Our model binds the theoretical study of CWD spreading speed together with empirical studies on deer home ranges and sets a base for models in 2D space to evaluate management and control strategies. (Coauthored with Evelyn H. Merrill and Mark A. Lewis, University of Alberta)