Contemporary population expansion of blacklegged Ticks (<i>Ixodes scapularis</i>)

Abstract:

The population densities of many organisms have changed dramatically in recent history. Increases in the population density of medically relevant organisms are of particular importance to public health as they are often correlated with the emergence of infectious diseases in human populations. Our aim is to delineate increases in density of a common disease vector in North America, the blacklegged tick, and to identify the environmental factors correlated with these population dynamics. Empirical data that capture the growth of a population are often necessary to identify environmental factors associated with these dynamics. We analyzed temporally- and spatially-structured field collected data in a geographical information systems framework to describe the population growth of blacklegged ticks (Ixodes scapularis) and to identify environmental and climatic factors correlated with these dynamics. The density of the ticks increased throughout the study’s temporal and spatial ranges. Tick density increases were positively correlated with mild temperatures, low precipitation, low forest cover, and high urbanization. Importantly, models that accounted for these environmental factors accurately forecast future tick densities across the region. Tick density increased annually along the south-to-north gradient. These trends parallel the increases in human incidences of diseases commonly vectored by I. scapularis. For example, I. scapularis densities are correlated with human Lyme disease incidence, albeit in a non-linear manner that disappears at low tick densities, potentially indicating that a threshold tick density is needed to support epidemiologically-relevant levels of the Lyme disease bacterium. Our results demonstrate a connection between the biogeography of this species and public health.