

MATHEMATICAL MODELS OF TICK-BORNE INFECTION: THE IMPACT OF HOST DENSITY AND TICK DEMOGRAPHY

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We develop a model framework to understand the link between host density, tick demography and the epidemiology of tick-borne pathogens. Our model links the development of specific tick stages to the specific hosts on which they feed. We show that host community composition and host density have an impact on the tick population dynamics, and this may play a crucial role on the host and tick epidemiological dynamics. A key result is that our model framework can exhibit variation in host infection prevalence for a fixed density of one host type due to changes in density of other host types, which may explain findings observed in the field. We also outline an expansion of the model system that includes seasonality in the tick life cycle. This can be used to understand how tick demographic characteristics may have an impact on the epidemiology of tick-borne infectious disease and may be used as a starting point from which to examine how environmental conditions and environmental change may influence the prevalence of tick borne infections and therefore the risk of spillover to human hosts.