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A CLIMATE-BASED MODEL FOR TICK LIFE CYCLE: AN INFINITE SYSTEM OF DIFFERENTIAL EQUATION APPROACH

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The distribution of ticks is essentially determined by the presence of climatic conditions and ecological contexts suitable for their survival and development.

We develop a general tick biology model to study the major trends due to climate change on tick population dynamics under different climate conditions. One of the main difficulty is that life cycle depends strongly on temperature and humidity.

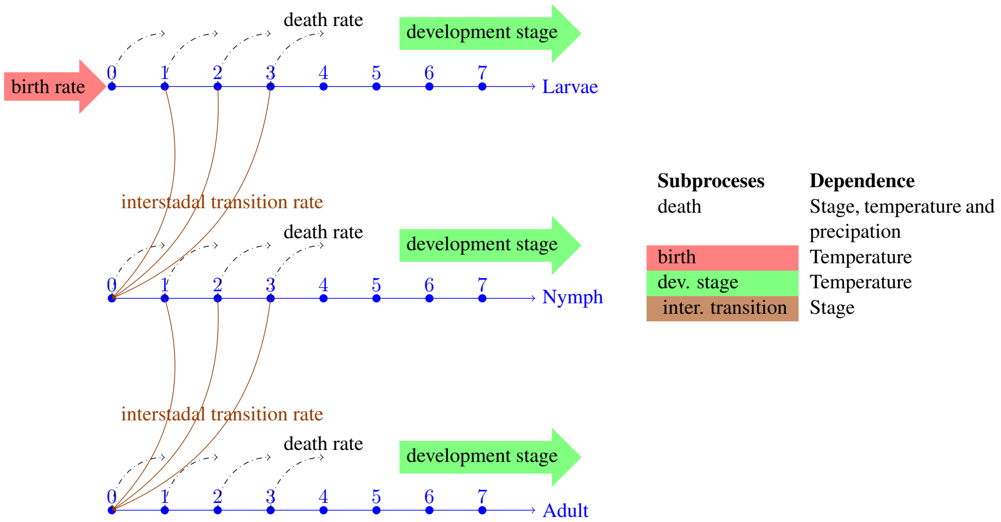

Figure 1: A schematic diagram for the model, identifying the input parameters and the model output (predicted number of ticks of each stage).

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We build a model that explicitly takes into account stage into each physiological state through a system of infinite differential equations where tick population density are structured on an infinite discrete set. We suppose that intrastate development process is temperature dependent (Arrhenius temperatures function) and that Larvae hatching and Adult mortality are temperature and precipitations dependent.

We analysed mathematically the model and have explicit the R_0 of the tick population. Therefore, we performed a numerical analysis of the model under three different climate conditions (tropical, Mediterranean and subarctic climates) and using climatic data from two different periods, $1901 - 1925$ and 90 years later, $1991 - 2015$.

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