Dan Pagendam, CSIRO Data61

Modelling the movement of mosquitoes through urban landscapes using an advection-diffusion driven Poisson process

Abstract

Aedes aegypti is a mosquito, originating from Africa but now ubiquitous across many of the tropical and subtropical regions of the world. This small insect is responsible for vectoring several life-threatening viruses including Zika, Dengue and Chikungunya, and consequently it is regarded as a serious threat to public health. In recent years, a number of biocontrol strategies have shown great promise for either suppressing *Ae. aegypti* populations or blocking the disease vectoring capability of the mosquito completely. A popular suppression strategy is the Sterile Insect Technique (SIT), which involves rearing and releasing large numbers of sterile male mosquitoes into the wild population, effectively reducing the number of viable offspring produced per mated female. Repeated release of sterile male insects has proven to be effective for complete eradication of some insect pests (e.g. the screw-worm fly in North America).

For mosquito populations, applying SIT at scale in towns and cities, requires knowledge of how far and wide a released male will travel to find a mate and how landscape features such as roads and buildings effect movement patterns. We investigated this research question through the use of mark-release-recapture (MRR) experiments involving male *Ae. aegypti* mosquitoes in Innisfail, Queensland, Australia. Mosquitoes were released from containers into residential areas where a network of traps had been installed, and where daily counts of marked mosquito were recorded daily from each trap. I will present an advection-diffusion driven Poisson process model that was developed to infer the movement patterns of mosquitoes through space and time, from trap count data. Through the use of a high performance computing cluster, this model allows us to conduct inference on model parameters and to make predictions about how widely we expect released males to travel and what landscape features might help or hinder mixing with the wild population, which is critical to the success of an SIT programme.