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Modelling mosquito dispersal in a heterogeneous environment

Mosquito foraging behaviour for hosts and oviposition sites/habitats is an important aspect for malaria control. Recent studies have highlighted the impact of the presence of habitats on mosquito search for oviposition sites. While others have highlighted the significance of habitat elimination within certain distances from human habitations to prevent mosquitoes using human hosts for blood meals. While minimizing or eliminating the impact of mosquitoes on the spread of malaria has been a concern of current malaria research, mosquito dynamics and mosquito spatial distribution remain a challenge. The goal of this work is to describe and understand mosquito population dynamics in relation to dispersal in spatial environments.

A simple mathematical model based on the mosquito life cycle is formulated to describe the population dynamics of mosquitoes. Dispersal of adult mosquitoes searching either for hosts or oviposition sites is also modelled and its effects incorporated in the population dynamics. The spatial aspect of mosquito dispersal is described by their movement between patches in a two-dimensional spatial environment. A hexagonal grid with each hexagon representing a patch is used where vital dynamics are allowed to occur. Numerical simulations are carried out to demonstrate the biological application of the model.

The modelled population dynamics of each stage of the mosquito life cycle in space are presented and the links between factors influencing the spatial dynamics are discussed.