

# A Stochastic Spatial Dynamical Model for *Aedes Aegypti*

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**Abstract** We develop a stochastic spatial model for *Aedes aegypti* populations based on the life cycle of the mosquito and its dispersal. Our validation corresponds to a monitoring study performed in Buenos Aires. Lacking information with regard to the number of breeding sites per block, the corresponding parameter (BS) was adjusted to the data. The model is able to produce numerical data in very good agreement with field results during most of the year, the exception being the fall season. Possible causes of the disagreement are discussed. We analyzed the mosquito dispersal as an advantageous strategy of persistence in the city and simulated the dispersal of females from a source to the surroundings along a 3-year period observing that several processes occur simultaneously: local extinctions, recolonization processes (resulting from flight and the oviposition performed by flyers), and colonization processes resulting from the persistence of eggs during the winter season. In view of this process, we suggest that eradication campaigns in temperate climates should be performed during the winter time for higher efficiency.

**Keywords** Mathematical ecology · Population dynamics · *Aedes aegypti* · Stochastic model · Dengue epidemics · Temperate climate · Spatial model · *Aedes aegypti* dispersal

## 1. Introduction

Dengue is an arboviral disease mainly transmitted by the mosquito *Aedes aegypti* and in the last years has become a major international public health concern (WHO, 1998, 2002). It is found in tropical and subtropical regions around the world, predominantly in urban and semiurban regions. As early as 1916, an epidemic of Dengue in Argentina affected the cities of Concordia and Paraná, and yellow fever epidemics decimated Buenos Aires between 1852 and 1905 (*Aedes aegypti* is also the main vector of yellow fever). In 1947, the Panamerican Health Organization led a continental mosquito eradication program, which was performed along the Americas and was based on the

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