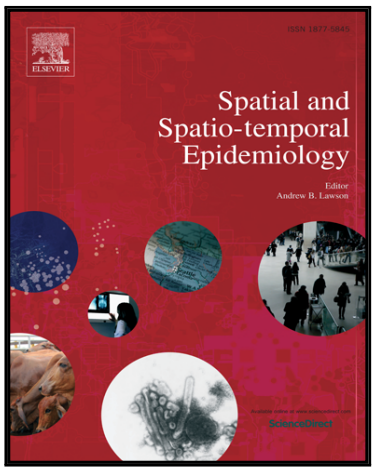

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Risk maps for cities: Incorporating streets into geostatistical models

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Abstract

Vector-borne diseases commonly emerge in urban landscapes, and Gaussian field models can be used to create risk maps of vector presence across a large environment. However, these models do not account for the possibility that streets function as permeable barriers for insect vectors. We describe a methodology to transform spatial point data to incorporate permeable barriers, by distorting the map to widen streets, with one additional parameter. We use Gaussian Field models to estimate this additional parameter, and develop risk maps incorporating streets as permeable barriers. We demonstrate our method on simulated datasets and apply it to data on *Triatoma infestans*, a vector of Chagas disease in Arequipa, Peru. We found that the transformed landscape that best fit the observed pattern of *Triatoma infestans* infestation, approximately doubled the true Euclidean distance between neighboring houses on different city blocks. Our findings may better guide control of re-emergent insect populations.

Keywords: INLA, Gaussian field, city streets, Chagas disease, vector, *Triatoma infestans*

1. Introduction

Vector-borne diseases are increasingly common in urban areas, and efforts to control these diseases are often targeted at the vector itself. However, detecting populations of disease vectors in large urban environments is especially complex (Weaver (2013), Knudsen and Slooff (1992)). Poor and unplanned urban environments can create ideal breeding grounds for many vectors, facilitating increased

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