

Mean Occupancy Time for Biased Edge Movement Between Two Different Habitat Types*

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Abstract

One of fundamental studies in ecology is to model the movement dynamics of various organisms in order to increase our capacity to predict biological development of population distribution. How biological organisms response to edges between two different habitats may be a major determinant of overall movement behavior. In this paper we study the insect behaviors by diffusion modeling with biased movement at circular patch boundaries. We obtain the probability density function that is discontinuous across the boundary where the bias occurs. Occupancy mean time for insect in different habitats are derived. The result offers quantitative measurement to describe the insect occupancy time under the influence of different types of habitat. Numerical simulations are presented to illustrate the obtained theoretical results.

Keywords: Diffusion equation; probability density; edge behavior, bias at boundary.

1 Introduction

One of the fundamental goals of theoretical ecology is to determine how the environment affects the distribution and dynamics of populations, as well as interactions among species. One way to try to understand how spatial effects such as habitat fragmentation influence populations is by using mathematical models. Reaction-diffusion models are often used to explain the effects of spatial heterogeneity in the environment on the persistence and population dynamics of species. One of the most challenging problems in such models is the response of organisms like insects to

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