The Coarse Grid Problem in Ecological Monitoring

N. B. Petrovskaya[1], S.V.Petrovskii[2]

[1]School of Mathematics, University of Birmingham, Birmingham, B15 2TT, UK

[2] Department of Mathematics, University of Leicester,
Leicester, LE1 7RH, UK

Abstract

Obtaining information about pest insect population size is an important problem of pest monitoring and control. Usually, this problem has to be solved basing on scarce spatial data about the population density. The problem of monitoring can thus be linked to a more general mathematical problem of numerical integration on a coarse grid. Numerical integration on coarse grids has been rarely considered in literature as it is usually assumed that grid can be refined. However, this is not the case in ecological monitoring where fine grids are not available. In this paper, we introduce a method of numerical integration that allows one to accurately evaluate an integral on a coarse grid. The method is tested on several functions with different properties to show its effectiveness. We then use the method to obtain an estimate of the population size for different population distributions and show that an ecologically reasonable accuracy can be achieved on a very coarse grid consisting of just a few points. Finally, we summarize our mathematical findings as a protocol of ecological monitoring, thus sending a clear and practically important message to ecologists and pest control specialists.