

Computational Methods for Accurate Evaluation of Pest Insect Population Size

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Abstract

Ecological monitoring aims to provide estimates of pest insect abundance, where the information obtained as a result of monitoring is then used for making decisions about means of control. In our paper we discuss the basic mathematics behind evaluation of the pest insect abundance when a trapping procedure is used to collect information about pest insect species in an agricultural field. It will be shown that a standard approach based on calculating the arithmetic average of local densities is often not the most efficient method of pest population size evaluation and more accurate alternatives, known as methods of numerical integration, can be applied in the problem. Mathematical background for methods of numerical integration on regular grids of traps will be provided and examples of their implementation in ecological problems will be demonstrated. We then focus our attention on the issue of accuracy of evaluation of pest abundance when data available in the problem are sparse and consider the extreme case when the uncertainty of evaluation is so big, that an estimate becomes a random value. We complete our discussion with the consideration of irregular grids of traps where numerical integration techniques can also be applied.