

Spatial Analysis in Bark Beetle Research¹

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Genetic and ecological information about bark beetle populations most often consists of data collected over space and time. However, when these data are analyzed, little attention is usually given to relationships operating in the spatial dimension. One of the reasons for the small number of studies that have examined the spatial aspects of bark beetle populations is the lack of statistical tools for the analysis of spatial-temporal data.

One statistical technique that can be adapted for the analysis of spatial data is the methodology of generalized linear regression models. This method was used in a series of articles by Mitchell and Preisler (1991, Preisler [in press], Preisler and Mitchell [unpublished]). By fitting an auto-logistic model, we were able to study the factors affecting the probabilities of trees being attacked by mountain pine beetle (MPB). Those factors included characteristics of individual trees (such as tree size and vigor), in addition to the locations of each tree within a stand. We have found that the framework of generalized linear

models is quite flexible and very helpful as an aid for understanding spatial patterns of discrete data points and for relating those patterns to specific environmental factors or tree characteristics.

The second technique that might be useful for the analysis of spatial data is the methodology of Geographic Information Systems (GIS). GIS can be used to store spatial and temporal information on insect populations. Genetic information can then be added to the system and used to analyze changes over space and time; interactions among and within various factors can be investigated. Although GIS allows entomologists to compile spatial data, deriving inferences from these data is still extremely difficult because appropriate statistical techniques are lacking. A few references that discuss statistical techniques for analyzing geographic information and gene-frequency maps are Brillinger (1990), Kemp and others (1989), Liebhold and Elkinton (1989), Piazza and others (1981). Further statistical research is needed in this area.

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