# ANALYSIS OF SPATIAL DENSITY DEPENDENCE IN GYPSY MOTH MORTALITY

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## ABSTRACT

The gypsy moth is perhaps the most widely studied forest insect in the world and much of this research has focused on various aspects of population dynamics. But despite this voluminous amount of research we still lack a good understanding of which, if any, natural enemy species regulate gypsy moth populations. The classical approach to analyzing insect population dynamics is the collection of a series of life-tables, stratified over several generations at the same location(s). This type of approach is valuable for detecting temporal density-dependent mortality and delayed density-dependence but recent theoretical studies have shown that the classical approach fails to quantify the relation of spatial heterogeneity in density and mortality and that this "spatial density-dependence" may have profound effects on the regulatory role of a mortality agent.

In this study we collected life table information that included estimates of gypsy moth survival and estimates of mortality due to specific causes. These life tables were spatially stratified within stands which facilitated the analysis for spatial density-dependence. These data were collected in stands where natural levels of spatial heterogeneity in gypsy moth densities existed and in stands where artificial gradients in density were created by introducing several million gypsy moth eggs into low-level populations.

Analyses of several natural populations indicated that mortality due to parasitoids and pathogens was largely independent of host gypsy moth density. In contrast mortality caused by three parasitoid species, *Cotesia melanoscela, Compsilura concinnata and Parasetigena silvestris*, appeared to be highly density-dependent in stands where artificial gradients of host gypsy moths were created. In these stands the spatial heterogeneity in gypsy moth densities was much greater than observed in any of the naturally occurring populations. Thus, these parasitoids probably operate in a significantly spatially density-dependent fashion only when spatial heterogeneity in host densities is great.