MIXED AND MODIFIED POISSON REGRESSION MODELS FOR THE ANALYSIS OF AGGREGATE TREE MORTALITY

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Aggregate tree mortality data collected from permanent plots tend to be highly variable, skewed, and frequently contain many zero observations. Such data have commonly been modeled using intrinsically nonlinear growth functions fitted by least squares, or, more recently, by a two-stage approach that supplements the growth function with a logistic regression to discriminate between the zero and positive data fractions. This study examines parametric stochastic structures for modeling mortality data with non-negative, discrete support. The Poisson, negative binomial (NB), and generalized Poisson distributions are considered, as well as their zero-inflated and hurdle modifications. Nonlinear regression models are developed and fit to data from a loblolly pine (*Pinus taeda* L.) spacing trial with a strong mode at 0. The sample data exhibit more variability than can be accommodated by a Poisson or modified Poisson model; mixed Poisson models incorporate the extra-Poisson dispersion and offer an improved fit. A hurdle NB model best describes this sample, but, like the other modified models and two stage approach, prompts the issue of overfitting. Considering both data-model agreement and biological relevance, the analysis suggests that of the models considered the NB model offers the most compelling and credible inferential basis for modeling stand-level mortality data.