# JOINT SPATIAL MODELLING OF RECURRENT TREE INFECTION AND GROWTH WITH PROCESSES UNDER INTERMITTENT OBSERVATION

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In this article we present new statistical methodology for longitudinal studies in forestry where trees are subject to recurrent infection and the hazard of infection depends on tree growth over time. Understanding the nature of this dependence has important implications for reforestation and breeding programs. Here, tree height is an intermittently observed, time-dependent and spatially-varying covariate that is subject to measurement error. We develop a joint model linking a counting process for recurrent infections with a nonlinear spatial growth curve representing the underlying height trajectories. The von Bertalanffy, logistic and Gompertz nonlinear growth curves are all considered within our proposed modeling framework. To accommodate spatial variability in growth parameters corresponding to trees at different locations, a flexible and robust non-Gaussian multivariate spatial process model is developed. We adopt a constructive approach based on kernel convolution that allows for non-standard anisotropic covariance structures when the kernel is modelled in a semiparametric fashion. In particular, a penalized smoothing approach based on a piecewise constant kernel and Markov random field priors is employed. Our methodology is applied for analysis in an eleven year study of recurrent weevil infestation of white spruce in British Columbia.