GYPSY MOTH LIFE SYSTEM MODEL

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ABSTRACT

The model is composed of four major subsystems that are driven by weather. The stand subsystem incorporates the effects of damage by the gypsy moth into annual tree diameter and height growth as well as tree mortality. These calculations are driven by ambient temperature accumulated for a year. The gypsy moth, predator/parasite, and pathogen subsystems are driven by the difference between daily minimum and maximum temperatures that are accumulated into 30 degree-day steps (step size can be altered by the user). Rain can also decrease gypsy moth development rates. Weather data can be introduced or stochastic weather generation requested. The gypsy moth subsystem follows the growth of the nominal insect in each cohort, density of insects, and larval movement between strata. The predator and parasite subsystem follows several natural enemy guilds and species that have been determined to be significant mortality agents of the gypsy moth; feedback is provided for some of these populations as gypsy moth is their food source. The pathogen subsystem follows naturally occurring nucleopoly-hedrosis virus (NPV), and introductions of both NPV and *Bacillus thuringiensis* (Bt) as insecticides. This subsystem models distribution of NPV in the environment and in infected gypsy moth.

The spatial scope of the model is a single forest stand. No spatial coordinates of trees are needed but the model does use vertical stratification of the tree canopies. The stand is partitioned by tree species and diameter class for calculation of tree growth and mortality and for calculations of foliage biomass for use in the gypsy moth portion of the model. Stand variables are updated once each year; these updates include stand management prescriptions imposed by the user.

Foliage, gypsy moth, and natural enemies are followed on a finer time scale within each year. After sufficient degree-day accumulation, foliage begins to grow and gypsy moth eggs begin to hatch. As long as the current generation of gypsy moth exists, each accumulated 30 degree-days produces another simulation step. Following the completion of an insect-generation cycle, annual summary accounts and links to the stand model are completed for a year, and another year produces another generation. These routines operate on a spatial scale that aggregates among the diameter classes for each tree species present. Four strata are distinguished: (1) overstory trees, (2) understory trees, (3) boles of overstory trees, and (4) a shrub and ground layer.

Four input data files are required and three others are optional. These provide the users with maximum flexibility in controlling the model. There are a number of table and plain ASCII text files that can be generated; the latter are designed for use as input to graphic packages or for use in statistical analyses.