

PHENOLOGY PREDICTION COMPONENT OF GYPSES

Jesse A. Logan, Lukas P. Schaub, and F. William Ravlin
Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

ABSTRACT

Prediction of phenology is an important component of most pest management programs, and considerable research effort has been expended toward development of predictive tools for gypsy moth phenology. Although phenological prediction is potentially valuable for timing of spray applications (e.g. Bt, or Gypcheck) and other management activities (e.g. placement and removal of pheromone traps), we have had a difficult time effectively conceptualizing phenology prediction in GypsES. We have come to the realization that difficulties in representing phenology over a complex topographic landscape, such as is typical of many gypsy moth control areas, lies at the heart of the problem. Our current approach to phenological prediction, therefore, has two goals (1) representation of the complex landscape expression of gypsy moth phenology, and (2) reduction (or aggregation) of this complexity to a form that is useful in the management decision process. To meet these two goals, the problem of phenological representation falls into two categories, Strategic Planning and Tactical Implementation.

Strategic Planning is the relatively static characterization of phenological attributes for a large management unit. In order to do this, it is first necessary to characterize temperature for the landscape in question. Sources of information for this characterization include, meteorological weather stations, and the information in the USGS-Digital Elevation Model. From such information, it is possible to characterize (model) the thermal climate (on the order of a 30 yr. average) for a complex topography (c.f.: Russo et al., these proceedings). The thermal climate would be expressed as a 1-km grid, or at some other appropriate spatial scale. The next step is to run an appropriate phenological model for each grid cell in the management unit. Results of these simulations will be stored in rapid access, numerical form. Various specified gypsy moth management objectives, for example prediction of the maximum density of 2-nd larval instars, could then be easily determined for each grid cell. Since the phenological information is stored as a numeric data base, it would be a simple matter to change or test alternative objectives. Once management objectives have been stated, management constraints can be superimposed over these objectives. For example, the minimum difference in occurrence of a phenological event to be considered significant is constrained by tactical realities. A manager might decide that differences of less than 3 days between occurrence of the target event are not important. Such constraints provide the basis for aggregation. The convenient ability to test various combinations of management objectives and management constraints provide the capability of determining, through trial-and-error, an appropriate phenological resolution for tactical planning. The main things to be gained through Strategic Planning are: (1) reduction of a complex landscape to manageable terms (2) identification of areas (spray blocks) that can be treated as identical units with respect to management decisions such as spray application dates, pheromone trap placement, etc. (3) Improved delineation of spray blocks when phenology combined with other data layers through the IGIS capabilities of GypsES.

Tactical Implementation refers to the actual determination (prediction) of within season phenological events in order to better implement the tactical application of suppression or other management activities. The basic problem is phenological prediction that takes into account the inherent variability of seasonal weather patterns. This will require a combination of historical and predicted temperatures. Early in the season, the best predictor will be that obtained from the generalized phenological characterization that resulted from strategic planning. As the season progresses, observed temperatures can replace the 30-yr averages used in Strategic Planning, resulting in a improved target date. It would also be possible to incorporate both short and long

term seasonal temperature prediction into the model phenology predictions. All tactical applications require real-time running of the model to reflect seasonal phenological progression. Such applications will be possible **only** if the Strategic Planning procedure has resulted in a significant reduction in the complexity of landscape phenology. This capability remains an open research question!

In summary, the problem is not development of adequate phenological models for gypsy moth. In our opinion we already have good models. The real problem in phenology prediction for management application is not one of too little information, but one of too much information resulting in an information overflow. There is a pressing need for effective synthesis and aggregation of information to result in a useful management tool.