

BEHAVIOR OF THE GYPSY MOTH LIFE SYSTEM MODEL AND DEVELOPMENT OF SYNOPTIC MODEL FORMULATIONS

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Aims of the research. The Gypsy moth life system model (GMLSM) is a complex model which incorporates numerous components (both biotic and abiotic) and ecological processes. It is a detailed simulation model which has much biological reality. However, it has not yet been tested with life system data. For such complex models, evaluation and testing cannot be adequately accomplished comparing the outputs with life systems data. Our strategy is to combine structural and functional analysis of the ecological processes within the GMLSM with development of synoptic models that incorporate the fundamental ecological processes, gradually increasing their complexity and reality.

Ultimately, we hope to achieve the following results: A. for the GMLSM: 1. Improve our knowledge of the life system, discover the weak points of present hypotheses and their linkages via parameter sensitivity and structural analysis, and thus direct further experimentation and modelling; 2. By evaluating and improving the GMLSM, we hope to provide a standard and clearly documented model which can be widely used, providing means to investigate optimal strategies for gypsy moth management under specific local conditions. B. for the simplified models: 1. Understand mathematical behavior and stability of models with regard for formulations, parameter values, and initial conditions; 2. Understand biological and ecological processes and parameters and how they should be most appropriately incorporated in models, i.e., how they should best be expressed in model formulations; 3. Understand how the mathematical characteristics of simpler models compared with the more detailed GMLSM and help us understand what in the GMLSM gives rise to the major stability and behavioral characteristics of the GMLSM.

Scheme of the research. The general scheme of our research is to parallel the work on the analysis of the GMLSM with construction of simple model formulations that provide means to explore major components of the ecosystem. These two approaches can be very complementary.

For structural analysis of the GMLSM, we have constructed flow charts to elucidate the basic components and interactions of the system model and each submodel. Computer diagnostic tools have a mechanism for step-by-step examination of calculations being performed. This process has already allowed us to uncover obscure behavioral problems and to correct inappropriate component interactions.

But is it structured on a sound biological basis, and is it interpreted correctly in mathematical terms and computer program representation? The most fundamental procedure is to evaluate the functional behavior of the basic ecological processes. This approach can be very helpful for constructing simple model systems. On the other hand, constructing and operating simple model systems in correspondence with the GMLSM can very efficiently detect errors in the GMLSM.

³Due to personal problems, Dr. Xu had to return to China; with the time required for international communication and the need to balance this work against other obligation, we do not expect this work to progress as fast as originally scheduled.