

LTFR Modeling Initiative

Simulation modeling and statistics are both techniques that can be used in the study of ecological systems. Statistical modeling of data is a tool suitable only for interpolation within the bounds of the observations. On the other hand, simulation modeling is a tool suitable for extrapolating our understanding of ecological systems into the spatial or temporal domains. Simulation models can help one evaluate hypotheses about the functioning of systems, stimulate the generation of new ideas, test experimental approaches, identify areas where research would be most beneficial, and reduce ad hoc experimentation. Simulation modeling can offer more power than statistical modeling for answering important questions about the functioning of ecological systems.

The network of LTER sites is founded upon the assumption that long-term ecological studies are essential to our understanding of ecological systems. Simulation modeling is a particularly appropriate tool to aid in the design long-term experiments or studies. It is also a tool with great potential for extrapolating our understanding of ecological systems beyond the boundaries of the sites to help answer regional and global scale questions.

A major problem with ecological modeling today is the shortage of expertise in systems analysis. One way to help alleviate this problem among the LTER sites would be to share the expertise available at some of the sites. We propose that an appropriate mechanism for helping establish modeling activities at the sites would be the formation of a group of representatives from each of the sites with interests in modeling. This group would meet on an annual basis for the purpose of disseminating information about current modeling activities at the sites, sharing information about useful methodologies, and coordination of modeling activities that may lead to useful intersite comparisons. Modelers not directly involved with LTER sites would be brought in to share their expertise.

The establishment of modeling activities at the LTER sites will be dependent upon the direction and interest of the Principal Investigators. Therefore, we propose that an essential part of a meaningful LTER modeling initiative will be one or more meetings for the PI's in which the benefits, constraints, and problems of simulation modeling could be presented for discussion. The meetings would be organized around examples of successful modeling efforts. To accommodate the busy schedules of the PI's, and to better represent the interests at the various sites, we propose to conduct two separate meetings. One session will make use of an example related to grasslands and deserts, while the other session will make use of an example related to forests. The grassland-desert example will draw upon the soil organic matter model of Bill Parton and his associates at

Colorado State University and the other example will use the forest dynamics model of Hank Shugart. The authors of the models would make the presentations and conduct a discussion about their construction, usefulness, and limitations emphasizing the applications and insights gained. If these meetings are as successful as we envision at this time they will aggravate the problems associated with a shortage of individuals with expertise in systems analysis.

To directly address the shortage of modelers, we propose to establish a fellowship program to provide significant training in systems analysis for LTER scientists. The program would initially be conducted at Colorado State University. LTER scientists interested in gaining expertise in systems analysis would apply for a fellowship to work with a specific modeler for a period of one year. The year would be spent at Colorado State University working half-time on a problem of interest to the fellow and half-time working on other modeling projects to gain a breadth of experience. The program would be funded through the coordinating committee or directly through the Ecosystems Studies office at NSF. Over a five to ten year period such a program could have a major impact on the availability of modeling expertise within LTER and ecosystem science. The cost of the project would be in the range of \$100,000 to 150,000 per year assuming an average of three fellows each year.