

Ecological Systems Analysis Draws Global Group

By William H. West

The Third International Conference on State of the Art in Ecological Modeling was held at Colorado State University in Fort Collins, May 24-28, sponsored by the International Society for Ecological Modeling (ISEM) in cooperation with the National Park Service Water Resources Laboratory and hosted by the CSU Natural Resource Ecology Laboratory. Scientists and land managers from Egypt, France, Austria, New Zealand, Denmark, Argentina, and The Netherlands as well as the United States, Canada, and Mexico attended the five-day conference to advance the development of ecological and environmental modeling.

The conference had as specific objectives: 1) to provide the first forum in North America for the international exchange of research results and applications in ecological modeling; 2) to expand the subject matter of the first and second conferences; 3) to provide more focus on specific problems in systems ecology and their solution by employing ecological modeling for managing the environment; and 4) to create a North American Chapter of ISEM to strengthen the international communication and interchange in this subject area. In pursuit of these objectives, papers were presented during technical sessions in five general areas: Energy Development, Theory and Methods, Water Resources, Animal Life, and Land Resources.

Papers presented in each of the five general areas ranged from theoretical, to applied, to aids and techniques useful in systems ecology. Many of the papers presented in the methods and theory session dealt with the problem of quantifying the interactions between different elements of an ecosystem. Questions were raised concerning the magnitude of direct versus indirect effects and how to determine these interactions. Many new and varied approaches to these problems were presented and while the proposed solutions are still highly theoretical, their applications to practical problems can be plainly seen.

Among the papers addressing today's practical problems were applied models in such areas as Spruce budworm outbreak and control, determination of optimal resource sampling, the effects of cultivation on crop yields, and recreation carrying capacity of ecosystems. Each of these models, and many more presented, was designed with the manager in mind. Limited data inputs and conversational interactive programs were just two of the methods used to make ecological modeling more responsive to the land manager.

New techniques, and old techniques newly discovered, were presented in papers to aid the modeler. In many instances, the procedures presented allow the modeler to better provide for the needs of the manager. Papers in the areas of curve fitting, modular programming, parameter estimation, and sensitivity analysis provide the systems ecologist with the tools necessary to better model an ecosystem and to evaluate the results of their modeling effort. These

procedures, in many cases, provide the modeler with the simplifications needed to convert ecological modeling from primarily a research tool to that of a management tool.

The closing session consisted of state-of-the-art reports in each of the five general areas with summaries of the previous sessions and an opening of the meeting to comments and discussions from the floor. In the course of the discussion, a clear consensus of the state of the art in ecological modeling emerged. It was widely accepted that the art is at a very primitive state. The field has made some strong advances over the last few years, as demonstrated by the quality of papers presented, but is not currently at the point where it can truly be called a discipline or concentration. The need was expressed by some for a unified approach to quickly advance the modeling field beyond its current condition. An opposing view was expressed by those who felt that because ecological modeling was still in its infancy it was premature to develop a unified approach. It was apparent that ecological modeling will evolve at its own pace and explore all avenues of thought.

Closely linked with the unified approach to ecological modeling was the concept of a global ecosystem theory. Although generally believed to be a decade away, and in some aspects a generation away, it was strongly felt that systems ecology provided the best opportunity for developing a general ecosystem theory. A global ecosystem theory advanced through systems ecology could remove much of the ambiguity currently faced in resource management, benefiting both the researcher and manager.

One concept universally expressed was the need for the modeler to become more in tune with the needs of the manager. To accomplish this the manager must be brought into the modeling process and made aware of the benefits and limitations of ecological modeling. The modeler must design programs with the user in mind through such techniques as limited data inputs, user friendly interactive programs, and modular programming. Additionally, the systems ecologist must gain a better understanding of the needs of the manager by better communications with management and through the concept of a modeler-manager dual training.

In general, the third international conference on State of the Art in Ecological Modeling was a success. Through the exchange of ideas and the discussion of new approaches the field of systems ecology was advanced. The concepts presented and the courses plotted will provide resource managers with new tools, and a clearer understanding of the ecosystem, both now and in the future. Through meetings such as this the field of systems ecology will become an ever-increasing segment of ecosystem research and management. Those interested in a copy of the conference proceedings, which include all papers and the five state-of-the-art summaries, may write to:

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Editor's Note: A Pacific Northwest modeling project, described in the most recent OSU/CPSU Annual Report (for 1981), is reported here.

Models to simulate ecological changes in Mount Rainier, Olympic, and North Cascades NPs have been developed for NPS by Jerry Franklin of the U.S. Forest Service, and Mark Harmon of the Oregon State University Department of Forest Science.

Study objectives were: (1) to develop a computer model that will simulate the birth, growth and death of trees in west slope forests of the Pacific Northwest; (2) to verify the model using a known data set from H.J. Andrews Experimental Forest and produce a document explaining model structure, limitations, and potential uses; (3) to use the model for comparing effects of clear-cutting, blowdown, and fire disturbance on succession of Douglas-fir forests in Olympic NP; and (4) to incorporate the influence of elk browsing and nurse-logs into the model and assess the impact of these variables.

The model has been constructed and verified, using the H.J. Andrews data set. A paper has been prepared explaining the structure of the model and potential uses, and a manuscript of the model documentation, by Dr. V.D. Adams, describes the subroutines used to stock, grow, kill, and disturb the simulated forest. The rationale for the equation forms, model results and validation also are presented, to give potential users of the model confidence in the model's ability to simulate changes in forest structure over time.

The model now is being used to test effects of clear-cutting, fire, and wind-throw on stand structure. Modeling effects are being combined with research conducted by James Agee (PNR research biologist) in Olympic NP. The influence of elk on structure of Sitka spruce-western hemlock was investigated in 1981 via the model and has been submitted for publication to *Northwest Science*.

The study's basic conclusion was that fluctuation in elk populations during the last 150 years have had little obvious effect on forest structure. Preliminary field work on development of trees on nurse-logs was completed and more extensive work is planned for summer 1982. The goal is to determine probability of a seedling growing on a log becoming a canopy tree.

In another spate of research on the role of nurse-logs, a set of experiments has been undertaken in the Hoh River Valley to determine factors that contribute to heavy use of logs as seed beds. The experiments will test the effect of seed predation, competition with other ground cover (e.g. mosses), flooding and soil pathogens. These experiments will be completed this summer.