MENT is to report on examples of progress toward the goal of integrating fire into land management.

In the following FORUM article, Franklin describes the role of simulation modeling in resource management. Owing to the complexity of modern questions and problems, our traditional intuition is often inadequate for the job at hand. Models, simulators, and information systems are not panaceas, but they can offer much needed assistance to today's land manager.

In the PROFILE article, Lotan answers the question: Why integrate fire management into land management planning? He makes a strong economic and ecological case for the re-evaluation of the role of fire. He also describes the concept and rationale for a USDA Forest Service Research, Development, and Applications (RD and A) Program, a short-term, goal-oriented, applications program devoted to the pay-offs of research. He specifically describes the Fire in Multiple-Use Management, RD and A Program, of which he is Program Manager, and emphasizes cooperative federal, university, and private research. Egging and Barney present a scheme for integrating fire management considerations into the planning process in the second PROFILE article. The final PROFILE article, by Eckles and Taylor, describes FIREBASE, a wildland fire bibliographic information system. FIREBASE includes citations, and in most cases, digests, of thousands of documents published worldwide on fire management and related topics. Searches may be conducted by subject area (such as, fire management analysis, economics, planning, training, and fire detection). The user may request simple citations, the "principal message," or a "specifics" digest.

Five articles are included in the RESEARCH section to illustrate the state-of-the-art in various aspects of fire and resource management research. In the first paper, I review the general problem of phytosociological inference—how community data are obtained, stratified, abstracted, stored, retrieved, and used for various resource management applications, and how these applications place constraints on data accuracy and resolution. The second research article, by Cattelino and others, presents an elaboration and further application of an elegant multiple pathway succession model developed in Australia by Noble and Slatyer. The model considers both disturbance periodicity and the component species' adaptive traits and life history characteristics to predict post-disturbance community recovery. The next article, by Vogl, reviews the often overlooked role of fire in grassland ecology and maintenance. Vogl suggests some chilling consequences that may result if traditional management policies are continued.

The following article, by Potter and others, describes the development of a new concept in resource management simulation and information systems. Named FORPLAN (FORest Planning LANguage and Simulator), it combines numerous data bases, models, simulators, and resolution level options into a single system, and has the additional attraction of being programed in common English words and phrases. The article also illustrates the integration and application of research results reported elsewhere in this issue.

The final RESEARCH article, by Omi, shows another use of mathematical models for fire management. He reports on the use of simulation models to examine the policy implications of fuel management strategies in the Angeles National Forest of southern California by simulating the impact of fuelbreak construction on fire damage potential.

The LITERATURE section includes reviews of three pertinent publications in the fire and land management area: the special Fire Management issue of WESTERN WILDLANDS (reviewed by Agee); the Proceedings of the Symposium on the Environmental Consequences of Fire and Fuel Management in Mediterranean Climate Ecosystems, held at Stanford University in August 1977 (reviewed by Thompson); and the new U.S. National Fire-Danger Rating System—1978 (reviewed by La Sala). We hope this Fire Management issue serves to illustrate state-of-the-art resource management research, and to show the tremendous amount of work still required to establish aggressive, competent management of our natural heritage.

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SIMULATION MODELING AND RESOURCE MANAGEMENT

ABSTRACT / Simulation models are becoming increasingly important as tools for synthesizing and applying information in almost all aspects of land management. They are particularly valuable for predicting and comparing outcomes of alternative decisions and assumptions. Models also permit managers to consider and integrate the potential influences of a large number of variables.

KEY WORDS: Simulation models, Succession, Data management
In this fire management issue of ENVIRONMENTAL MANAGEMENT there is a great deal of space devoted to mathematical modeling of fires and fire effects. The range of such simulation efforts is wide. Some have as an objective short-term predictions of fire behavior—what will it do and when. Others concern post-fire succession, simulating changes that will occur in forest composition and structure (including fuels). These are sophisticated tools that, at least on the first encounter (and maybe the third, as well), appear complex and mysterious to the land manager. They can be expensive to develop and, like most modern tools, require substantial investments of time and money before they are debugged and apparently reliable for “local conditions.”

Why are land managers increasingly involved in such efforts? Intuition and knowledge, developed from experience and simplistic models that are based upon one or a few factors (and often not recognized as models), have served us well in the past. Why involve ourselves in these complex computer simulations where it is frequently difficult to understand the basis for the final predictions?

What Questions Are Being Asked?

I believe the reasons for our increasing involvement with simulation models can be found in the types and numbers of questions land managers are asking, as well as those being directed to them by the public. Let’s consider a few examples.

On a hot afternoon in July a fire control officer in Glacier National Park receives a report of a fire. What suppression activity will be undertaken? It is an area where one could consider letting the fire burn unimpeded. But what is the rate and direction of fire spread? How big will it be in an hour, six hours, 24 hours? Many factors interact in prediction of this type, including the fuels in the vicinity, current and predicted weather, and topography.

In another region, foredunes have come to the Pacific coast with the introduction and naturalization of European beachgrass (Ammophila arenaria). These dune ridges run parallel to the ocean at the landward margin of the beach and are more or less stabilized by vegetation. Along the seaward edge of the Coos Bay dune sheet in coastal Oregon, the sands are no longer free to blow inland. One unfortunate consequence is that the area of “live” dunes is dwindling within the Oregon Dunes National Recreation Area. How can these outstanding features be perpetuated? The manager of the area struggles with the “sand budget” for the dune sheet. How much foredune removal is necessary to allow passage of the sand increment necessary to maintain a viable, open dune sheet?

Staff professionals in wildlife and silviculture in a western National Forest consider long-term needs for large, standing dead trees or snags that are critical for wildlife. What prescriptions will maintain the necessary continuous flow of these structures as most natural stands are converted to a managed state, as the currently reserved snags decay and fall, and as shorter rotations reduce average tree size?

In a western National Park the superintendent considers alternative fire management policies. If a policy of essentially complete fire suppression is continued, what will the park look like 50, 100, or 200 years from now? Will individual species be endangered? What will be the impact on insect epidemics, visitor safety, and pre-suppression activities?

Within a small Oregon estuary, restoration of the natural vegetation is adopted as the long-term management objective. For many years, most of the original salt marsh has been diked for agricultural use. How should the responsible manager implement the restoration policy? Are extensive mudflats a necessary early result of dike breaching? What timing and techniques will lead to the desired result with minimal ecologic and aesthetic damage?

Elsewhere foresters and soil scientists consider the effects of different management strategies on the fertility and long-term productivity of a forest site. How will short rotations affect the nutrient balance sheet? Can productivity be maintained without fertilization? What are the effects of whole tree harvest and stump removal?

Nature of These Questions

The land management problems just mentioned vary in subject, scale, and applicable techniques. Nevertheless, they have several important features in common and, as a group, represent a major class of questions being asked today.

First, typical questions currently faced in land management are very complex. Managers must be concerned with the multiple ramifications of their actions. They are concerned with impacts on the overall ecosystem rather than the impact of a specific action upon a target resource or organism. When, of necessity, economic and social considerations are added to the biological and physical, the issues become even more complex. The input of large