Fire Management and Vegetation Effects in Mediterranean-Type Ecosystems: A Summary and Synthesis

David J. Parsons

In order to develop and implement an effective fire management program in fire-prone environments, it is necessary to understand both the fire history of the area and the effects of fire on the local biotic communities. It is also necessary to clearly identify the objectives of the program. Once such information is available it is possible to implement a fire management program that accomplishes the desired objectives. This may include the use of prescribed burning and/or natural ignitions, together with any of a variety of physical or biological manipulations.

The papers in this session present examples of both the types of input needed in the development of fire management programs for Mediterranean climate ecosystems as well as selected examples of the implementation of such programs. While they by no means represent a complete analysis of the situation they do constitute a representative cross-section. The papers by Keeley and by Radtke, Arndt and Wakimoto deal with the question of fire history on a large and small scale, respectively. Both papers focus on the importance of the local vegetation in determining fire frequency and burning pattern. The paper by Minnich deals with the additional problem of the effect intense grazing has had on altering both the present vegetation and recent fire history. Trabaud adds an international perspective with his analysis of the history of man’s use of fire and its effects on the vegetation in the Mediterranean region of France. Vélez carries this approach a step further by detailing the development of multi-faceted fuel management programs in the Mediterranean ecosystems of Spain. Finally, Green describes in detail the guidelines needed to implement a prescribed burning program in southern California chaparral.

The first problem which must be faced in the development of a fire management program is the identification of management objectives for the area. In Mediterranean climate ecosystems this is especially important in that the dominant vegetation types are commonly recognized as highly flammable and having evolved with periodic fire (Mooney and Conrad 1977). Examples of the types of management objectives that must be distinguished between include fuel hazard reduction (Biswell 1977, Green 1977), preservation of naturally functioning ecosystems (Parsons 1977, 1980), promotion of conditions favorable to wildlife (Hendricks 1968, Lillywhite 1977), increasing water yield (Hill and Rice 1963) and the elimination or maintenance of specific vegetation types or plant species (Kayll 1974). These objectives are often mutually exclusive. Which one is chosen will influence both the type of program to be adopted and the details of how it is implemented.

In developing a fire management program it is essential to understand the ecological role of fire in the area of concern. This includes an understanding of the effects of fire (including different intensities, seasonalities, and frequencies of burning) on survival, reproduction and succession of the local vegetation. It also includes an understanding of present and past fire history.

Keeley’s paper “Distribution of lightning and man-caused fires in California” looks, on a regional level, at recent burning patterns and compares them to that occurring under “natural” conditions. Keeley analyzes the distribution of lightning and man-caused fires during the 1970 decade in relation to latitude, distance from the coast, time of year, elevation, acreage and fuel type. This represents the most complete effort to date to summarize data on the present fire regime in California. Keeley recognizes, however, the difficulties in extrapolating data on present lightning fire frequency to represent “natural” conditions (he defines “natural” as being “prehistorical”). This is due to the fact that man now extinguishes many fires before they get very large, as well as setting other fires; thus altering considerably the fuel conditions potentially available to burn in lightning fires. This problem could be somewhat alleviated for at least some vegetation types by defining “natural” as referring to “presettlement” conditions (as has been done by the U.S. National Park Service who includes aboriginals as part of the natural scene), Keeley’s approach is only exacerbated in those areas with longer periods of human occupation and consequent vegetation modification (Naveh and Dan 1973). In such conditions, or whenever long term fire history records are needed, fossil charcoal or pollen analysis may be the best hope for documenting ancestral fire history (Swain 1973, Byrne et al. 1977).

Radtke, Arndt and Wakimoto’s paper “Fire history of the Santa Monica Mountains” deals with the problem of documenting fire history for a relatively localized area. In addition to surveying historical accounts and more recent fire records, the authors focus on those factors influencing fire history and behavior. A careful analysis of local patterns of vegetation, topography, climate and land use in relation to ignition sources, together with case studies of specific fires provide a good understanding of the conditions under which different types of fires occur. This approach is of considerable value in understanding
local fire behavior and predicting future burning patterns. It is of more limited value in eluci-
dating historical or prehistorical fire frequencies or patterns. Unfortunately it is difficult to use
standard fire history techniques for shrub and herb communities (Parsons 1981).

When land management practices greatly alter the vegetation of an area the historical role of
fire can change significantly. Minnich deals with this problem in his paper "Grazing, fire, and
the management of vegetation on Santa Catalina Island, California." In this case grazing by feral ani-
mais has denuded the vegetation to such an extent that fires will generally not carry except in ungrazed grasslands. The problem thus becomes one of what would happen to the vegetation and fire potential should the feral goats and pigs be removed. Should this proposal be carried out, Minnich recommends a management program of using prescribed burning to develop a mosaic of com-
munity types and age classes. This should reduce the potential of destructive wildfires while
returning to a more natural vegetative mosaic. It would also serve the desired function of protect-
ing the watershed. Similar problems are faced in many heavily grazed Mediterranean climate eco-
systems (Naveh and Dan 1973).

Trabaud's paper "Effects of past and present fire on the vegetation of the French Mediterranean
region" adds an international perspective to the study of fire history and effects. Trabaud re-
views the history of man's use of fire in southern France and how it led to the degradation of much
of the area's landscape. He discusses in some detail the adaptations of various French meditter-
anean species to fire as well as post-fire suc-
cession in the Quercus coccifera garrigue following different frequencies and seasons of burning.
This type of detailed information on the effects of varying fire regimes on species composition,
cover and biomass is essential to being able to predict the effects of a fire management program.
The methodology presented (see also Trabaud 1977) provides a useful model for fire effects studies
anywhere.

Vélez's paper "Fire effects and fuel management in Mediterranean ecosystems in Spain" focuses on
the development and implementation of a multi-
faceted fuel management plan. Based on the ob-
jective of protecting the forests from destructive wildfires, the program focuses on means of fuel
reduction. These include physically removing or chipping slash fuels, building fuel breaks, type
conversion, grazing, encouraging hyphrogenic
species and using controlled fire. Much of the
intent is to develop and maintain mosaics of
species, age classes, biomass and flammability
that will serve as fuel breaks. The program
recognizes fire as an important evolutionary
factor. It also recognizes that an understanding of flammability and fire adaptations of the
important species is essential to developing an
effective fire protection program. Research is
being carried out in conjunction with the manage-
ment program on the effects of fire on soils,
vegetation succession and regeneration and refine-
ment of prescribed burning techniques to achieve
desired results. The paper also investigates
possible economic uses of slash chips for particle
board and briquettes for fuel. Such economic
spinoffs may be of increasing value in future
years.

The development and refinement of burning prescriptions (temperature, humidity, wind, fuel
characteristics, fire types etc.) to achieve specific management objectives requires consider-
able experience and experimentation. Green's paper "Prescribed burning in the California medi-
terranean ecosystems" summarizes many years of data collected for prescribed burns in southern
California chaparral and mixed-conifer forests.

He presents recommended prescription ranges for low, medium and high intensity fires for such
elements as fuel volume, dead-to-live fuel ratio, live and dead fuel moisture, chemical content,
time of year, topography, wind, relative humidity, and air temperature. While the data presented are
for southern California the general approach is
valid for any fire management program. The spec-
ific values must be refined for the management
objectives and vegetation of the area of concern.
Green's paper should be of considerable value as a
model to be followed in developing prescriptions
for other areas.

The papers presented in this section represent
selected examples of the types of information
required to develop a fire management program.
They do not, nor are they intended to cover all
aspects of fire history or vegetation effects
studies either available or required for any fire-
prone area. Regardless of objectives, such a
program requires an understanding of past and
present fire regimes (frequency, periodicity,
ignition source, seasonality, intensity etc.) as
well as the effects of fire on the local vegeta-
tion. Such an understanding requires detailed
research which must be closely tied to the areas
management program.

LITERATURE CITED
Biswell, H. H. Prescribed fire as a management
Consequences of Fire and Fuel Management in
Mediterranean Ecosystems. USDA Forest Service
Bryne, R., Michaelsen, J. and Soutar, A. Fossil
charcoal as a measure of wildfire frequency in
southern California: a preliminary analysis.
In Proc. Symp. on the Environmental
Consequences of Fire and Fuel Management in Mediterranean
Ecosystems. USDA Forest Service Gen. Tech.
Green. L. R. Fuelbreaks and other fuel modifica-
tion for wildland fire control. U.S. Dept.
Hendricks, J. H. Control burning for deer manage-
ment in chaparral in California. Proc. Tall
Hill, L. W., Rice, R. M. Converting brush to grass increases water yield in southern California. J. Range Manage.; 1963; 16(6):300-305.


